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Was It Justice?

The "Legal Notes," or brief abstracts of actual cases acted upon in the various courts, which from time to time we print, are usually assumed to convey some information as to the law, or as to some interpretations or applications of the law, under circumstances actually occurring, and likely to occur again in manufacturing establishments. Some of the cases, however, contain no such information, and may be regarded rather as curiosities in legal procedure, and in some cases as evidences of the misinterpretation of law or of fact resulting in the miscarriage of justice. In the case referred to in our issue No. 43, for instance, the final result of the suit would seem to be unjust and absurd.

In this case, it may be remembered, a woman was employed in a mill in Georgia, her specific duty being to feed a certain machine. When the machine got out of order she naturally could no longer feed it, and, naturally also, it was then her duty to notify the superintendent. This she actually did on a certain day, and when the superintendent came to see what was the matter she proceeded to help him. She took hold of a certain cloth and her hand was drawn into the machine and injured. In her suit to recover some compensation for the injury, both the trial court and the Supreme Court on appeal decided against her, on the ground that when she was injured she was acting beyond the scope of her duty in trying to show the superintendent the nature of the derangement. The court said, but not in these words, that if she had stood there like a stick she would have been all right, but as she took hold and tried to help the work along she became a volunteer, and "it follows," as the learned judge said, "that the master was under no duty of protecting her from injuries received while she was a mere volunteer, endeavoring to accomplish something entirely outside the scope of her employment." It was further alleged against her that she was negligent while the accident was in process of accomplishment, because she didn't jerk her hand away quick enough. She was too active and she was not active enough.

The plea that she was acting outside her specific duties would seem to be disingenuous. It is a fact that employees are never satisfactory who stand upon the strict limitation of their actual work, and those who are sticklers for what they may define as their rights, and who refuse to make a move or to do a thing beyond what they are specifically paid for, are not long retained. An employee is expected to be true to the interests of his employer and to do what he can to help things along. If he is not willing to do this he is not wanted. If this poor woman had not tried to do what she could to get her machine going again, if she had not done precisely what she did do, it is most probable that it would have been reckoned up against her, if, indeed, she had not been discharged on the spot.

Men are constantly preached to—we do it because we believe in it—that the way to get along is to help the employer to get along. It is very distinctly a discouragement to a man to tell him that the minute he does try to do something that he believes will be helpful, and that he intends shall be helpful, and which the employer approves, or at least permits, as with the superintendent and the woman, if it happens to be outside of certain strictly specified duties, he at once cancels all obligation of the proprietor towards him. Up to the moment when the accident occurred to the woman there can be little doubt that she was doing nothing more than she was hired to do, and expected to do, but just as soon as the roll began to pinch, then the proprietor was ready to claim that she was doing what she had no business to be doing. Law does not always look like justice.

Manufacturers Asked to Support an Irrigation Scheme.

The National Irrigation Association sends us an appeal for the support of the objects of the association, which appeal is directed especially to merchants and manufacturers and they are asked to endorse the plan of having the government construct immense storage reservoirs to store the water which now runs to waste during the winter and spring floods and use it for irrigating what are now the arid lands of the West and thus making them able to "support a dense population." It is stated that the government owns one hundred millions of acres of land which is now worthless but which can be made valuable by irrigation and that the money for which it can then be sold will repay the government for the outlay.

In such matters as this, however, we are too apt to forget the important fact that the government can have no money with which to carry on such a work as this, except as it takes it from those who are by physical or other labor creating the values that are taxed for government revenue, and we are unable to see the justice of taking the prodigious cost of the proposed irrigation improvements out of the pockets of one generation in order that succeeding ones may have a wider territory. If the work could be caried on by issuing long-term interest-bearing bonds, interest not to accrue for, say, the first five years or until the revenues from the irrigated land began to come in; prinpal and interest to be paid out of the revenue arising from the lease of the lands thus brought into use, there would be some justice in it, but to take the money out of the pockets of those who to-day are carrying on the work of the country, for practically making a new territory, which, in a generation or two perhaps will have passed entirely into private hands cannot be just. We fail to see what benefit would

result to most of those who would have to pay in taxes the money required for the work, and we believe that the children of most of them would not be one whit better off than they would be had the work never been undertaken.

This matter of taxation has got to be revised somewhat, if we are to hold our place in foreign trade and develop our share of it. If the manufacturing and commercial enterprises of the country are to take the position in the world's markets that they are of right entitled to take, they must not be ball-and-chained by unnecessary taxes nor taxes which fall mainly upon productive enterprises and upon workers, as too many of our present taxes do, and as the taxes to carry on the proposed work would, unless the special plan we have outlined or some other is adopted.

On German Machinery Trade.

In a recent number we printed an interview with Mr. Binsse, of the Newark Machine Tool Works, in which he was quoted as saying that while the Germans will not keep on buying the standard tools which until lately they have been taking up so readily, they will always keep an open market for newly improved machines. We believe that herein is the best answer that can be made to the question, What is to become of our foreign tool trade? so far as it relates to Germany or to any country that now has a manufacturing development.

The men who are returning from Europe all bring back the same story of sharp declension in our machine tool trade with Germany and the neighboring countries. It looks to some almost as if our market there were a thing of the past. Before deciding whether to believe this it is well to consider what were the causes of the remarkable buying movement that prevailed during the last four years; for surely if the same reasons exist hereafter, the same results will follow.

There were, in the main, two such causes. One was the industrial revival of Europe, which surpassed her ability to supply her own tools as fast as wanted, and turned her to us for assistance. This condition has now passed away, and although it may be repeated, it would be idle to predict that this will take place soon.

The other cause for the export boom was the inventive American genius, which had produced a class of tools quite above the plane of anything the continental nations had learned to construct for themselves. They have now found out something of the art of doing so, and are in larger measure doing it. We cannot reasonably expect to keep on selling them such tools over and over again in anything like the quantity that we could when these were a novelty. The American inventive faculty, however, was not exported with the tools it had produced. It has been retained at home to design machines still newer and more highly improved. When these are brought out they will in their turn find a European market as unique products of American skill. It is only necessary for our American manufacturers to keep in the lead technically, and the commercial results will—not take care of themselves, but will be assured with reasonable cultivation. It will never do to stand still or to try to rest upon laurels already won. We are, so to speak, in a treadmill, and must be constantly treading upward in order to hold our own. Such is the order of all the affairs of life, modern life especially; nor is the American manufacturer of machine tools the least fitted to obey this inexorable law.

The Electric Tower.

Every well-regulated exposition has its "press agent," who is at the head of what is called the "bureau of publicity." The Pan-American Exposition has such a functionary, who has sent us yards of material; but most of it, while it is all right for some publications, is scarcely adapted to our use. The style of the following, for instance, is a little more florid than our readers are accustomed to seeing in these columns, but will serve to give an idea of what will probably be one of the most prominent features of the exposition:

"The grand centerpiece of the Pan-American Exposition is the Electric Tower. Five thousand horse-power has been provided for the electric features, part of which will be used to illuminate this beautiful structure. One of the great Swiss turbines at Niagara Falls has been set aside to supply this immense volume of energy. The Electric Tower is to be 375 feet in hight, having a base 80 feet square to a hight of 200 feet. This base is flanked on the east and west sides by colonnades, 75 feet in hight, semicircular in form, which curve toward the south, forming a clasp setting for the great basin of the Electrical Fountains. From the fountains to the Goddess of Light, the tower will be one mass of quiet beauty by day and of fiery, sparkling grandeur by night. Abundant streams of pure water, transparent while the light of day lasts, will be transformed at the approach of darkness into all the colors of the rainbow. Great serpents of vari-colored fire will crawl around and over this immense tower, while red-eyed imps will drown goblins and dragons in the depths of the molten lake. Elevators will take visitors to the restaurants upon the colonnade, where they will have a commanding view of the broad and beautiful Court of Fountains."

"Ability."

We do not now recall the name of the genius who invented "ability" as a factor in the production of wealth distinct from the factors previously known as land, labor and capital, but we see that it suits the purposes of some people to take up the idea that men of exceptional ability, inventors, managers, organizers, etc., do not perform labor—they merely exercise their "ability" and thereby wealth is increased and labor, that is, the kind of labor that most of us perform, is rendered more productive and in fact given many opportunities to apply itself that would otherwise be lacking. This new invention enables some observed facts to be apparently reconciled to pet theories, and consequently we suppose will be kept alive in certain circles, but it is nevertheless utterly nonsensical. A man may have transcendent ability, but unless he labors his ability will never do him nor anyone else the least good in the world. Workers have and exercise all degrees of ability from that which is needed only to handle a pick and shovel on a railroad embankment to that which is required for administering the affairs of a railroad or inventing new and improved methods or machines for doing its work; but every person who exerts himself for a useful purpose works, and the man who bends over the drawing board scheming and delineating improvements in machines and tools as truly works as does he who afterward builds or operates the machines. There are many degrees of mental ability, and it is not only inevitable, but also right that those who can bring most of this ability to bear upon their work should secure the most desirable positions and receive the highest pay, but to draw a line between work and the exercise of "ability" is without rhyme or reason, and to attempt it will result only in confusion and harmful misunderstanding.

The recent awards to American firms of contracts for railway trucks for South Africa are provoking unpleasant remarks in England. The facts, which are told in the "Daily Mail," London, speak for themselves, and seem to require not a word of comment. Lower prices and quicker deliveries are too much to compete with, don't you know?

"Tenders were invited from the principal British and American firms. The Americans offered to supply everything in three months, but the English tender promised only a portion of the trucks in seven months at a price quite 30 per cent. higher than the American figures.

"Anxious to encourage British manufacturers, we placed, roughly speaking, a third of our order with British manufacturers and two-thirds with American. I do not know what our people of the Rand will say to our decision in consenting to a heavy delay in the delivery of a portion of the trucks."

A United States patent recently issued to Frank J. Sprague, of the Sprague Electric Company, for a Traction System, contains 263 claims, which is a considerably higher number than in a patent which we referred to a short time ago.

Commercial Review.

NEW YORK, Saturday, November 10.

THE MACHINE TOOL AND OTHER INDUSTRIES.

A satisfactory amount of improvement is seen in the iron trade and its branches now that election is over. There is perhaps less ostentation about it than in the spurt of activity that followed the election four years ago, but it seems to be of a more substantial nature. In 1896, it may be remembered, the announcement of the result of the ballot was followed by a hysterical attempt to bring about a boom immediately. Idle mills were set running almost by the score without waiting for orders. The orders did not come, and in two or three weeks the mills were shut down again and industry was as slack as ever. This season the basis of industry is broad and strong to start with and the confirmation of business confidence sets free a large amount of trade to build upon it. So many *bona fide* enterprises were known to be waiting only till the election was over to go ahead that a sufficiency of work seems to be assured. Much of it is known to have materialized in contracts even at this early day. The railroads are placing large orders for cars, bridges, etc. For instance, the Baltimore & Ohio Railroad has closed a deal with the Pressed Steel Car Company for 6,000 cars, ordered conditionally, in effect, though formally, before the election. It is reported in Pittsburgh that the Riter-Conley Manufacturing Company has contracts aggregating $6,000,000, which had been held in abeyance until after last Tuesday. Already the iron and steel market feels the improvement in business and prices are strengthening in most of its branches.

Machine tools share the general improvement, though as yet it is evidenced chiefly by a better feeling. The selling trade is looking for a brisk business henceforth, not equal perhaps to the stampede of 1899, but much better than for the last six months. In spite of the short interval since election, some improvement is already seen in actual buying. Deals that had been hanging fire till after election are being closed. The volume of those waiting contracts is considerable. A quantitive estimate has been heard in the case of a Philadelphia store which has $65,000 or $70,000 amount of them. One prominent local company noticed a revival of buying two or three weeks before the election, rather than since, from which they infer that the results were discounted. In contrast to the generally reported effect of the ballot upon business is the experience of one of our most prominent tool manufacturers in suffering the cancellation of a contract because Bryan was defeated.

It is not generally believed that there will be any advance in the prices of machine tools for the present at least. If shops again become filled up with work, as they were last year, a rise is thought possible. But even in that case we suppose it would depend considerably upon a material recovery in the iron market.

There is said of late to have been a serious lapse of activity among automobile manufacturers. Three of the largest and most substantial companies in this and adjoining States are named, each of which has suffered. One of these is referred to as having practically shut down, another laid off 200 men and is reported to have since laid off 200 more, comprising in all more than half its force, while a third dropped 200 a few weeks ago, but has subsequently begun to hire anew. The last-mentioned circumstance affords hope that whatever depression in the industry existed has passed its worst and is now on the mend. The automobile show now in progress in New York may stimulate trade.

The Toledo Machine and Tool Company during the present year has given considerable attention to the requirements of shovel manufacturers and has installed several large plants for this purpose, among others that of the Laughlin Nail Company at Martin's Ferry, Ohio. This plant is supposed to be one of the largest and best equipped in the United States. The Toledo Machine and Tool Company is now negotiating for the equipment of another plant for shovel manufacturing which will have considerable more capacity than any now in operation in this country. Since removing in 1898 to their present enlarged quarters, they have added largely to their equipment, and have more than trebled their capacity for producing punch presses and special tools for sheet and bar metal work.

The American Bridge Company intends to complete the new works of the Berlin Iron Bridge Company, at Economy, near Pittsburgh, Pa., which were in process of construction at the time the latter company passed into the control of the former. It is expected that they will be made much larger than contemplated in the original plans—in fact, large enough to turn out 120,000 to 150,000 tons of finished product per year. Pneumatic and electric power will be used in the plant and labor-saving devices of all kinds will be installed. A feature of the project is the equipment of a shipyard for the manufacture of steel barges and hulls with a yearly capacity of 100 or 200 river craft, to be increased eventually.

At the Pan-American Exposition, to be held in Buffalo next spring, the power plant will be provided with a complete duplex induced draft apparatus, comprising two full housing up-blast steel-plate fans, about 17 feet high, with overhung wheels and water-cooled bearings. These fans will be direct-connected each to a 12x14 inch horizontal center-crank engine with automatic governor, and are designed to serve 17 Manning boilers of about 3,000 horse power capacity, discharging the gaseous products of combustion into two short stacks of sheet steel. The fans, engines and breaching connections for the boilers, together with the steel-plate stacks, are constructed by the Buffalo Forge Company, of Buffalo, N. Y. The same company is also building for the Exposition a horizontal center-crank class A tandem compound engine of 300 horse-power for electric-lighting purposes, and it will construct the heating and ventilating plant for the permanent New York State building, of which George Cary is the architect.

TOOL TRADE CRITICISMS FROM WILMINGTON.

The tool-building shops of Wilmington, Del., are in a good state of activity and with little accumulation of stock. It is admitted, however, that the receipt of orders during the past few weeks has not been at a rate to keep the shops in their present condition, although all agree in saying that since about the middle of October there has been an almost phenomenal influx of inquiries. The meaning attached to this is the natural one that the inquiries represent intentions which are likely to be acted upon now that the election is out of the way. So far from feeling discouraged at the domestic situation, the tendency is toward self-congratulation that the election has disturbed business so little. The only note of pessimism relates to foreign trade. The slump in business in Germany—which appears to be much more pronounced than is usually understood—has led to a marked decrease in business there, and the almost simultaneous completion of several large German tool-building shops will, it is feared, lead to a permanent loss of much of the German market and increased competition in others.

CHICAGO MACHINERY MARKET.

Electric machinery manufacturers who supply equipment to the large street railway systems report all the business they can attend to. The consolidations of railways in various cities and their extensions, as well as the rapid development in electrical machinery, are calling for large expenditures for new equipment. It is said that some outfits installed no longer than a year ago are being displaced for improved power machinery by the large traction companies on the ground of more economical operation. The old equipment is thrown upon the market and, on account of the low prices at which it is offered, finds ready sale among some of the smaller street railway companies.

For factory purposes, present demand for electrical outfits is generally light. Whatever good effects may be derived from the ending of the Presidential campaign have not presented themselves as yet. There is much work in prospect. The representative of one large electrical machinery maker says that from his personal knowledge there are contemplated in the West shop constructions and improvements to the cost of several million dollars. It is his estimate that within

a radius of 500 miles from Chicago industrial building projects to the value of $25,000,000 are in contemplation. Cement works, for which there is great popularity, and machine shops, are among the important branches of industry that are thus prospectively active.

The Northern Electrical Manufacturing Company has sold an electrical equipment of about 1,000 horse-power to the Muscatine, Iowa, street railway company. A novelty is the contract taken by the Crocker-Wheeler Electric Company for three 75-kilowatt generators, direct connected, for the cold storage warehouse of A. Booth & Co., in this city. The installation of engines, boilers and generators will be made on the eighth or upper floor of the storage house. The Holtzer-Cabot Electric Company has sold forty-one motors to the W. C. Ritchie Company, box manufacturers, this city.

Bids are out for the electrical equipment of the Denver (Col.) shops of the Pullman Palace Car Company, requiring about 500 horse-power. Charles A. Pratt, consulting engineer, has prepared plans for an electrical equipment for the Chicago shops of the Link-Belt Machinery Company.

This is the busy season for municipal lighting plants. Installations are rushed and not a few new contracts are being closed. One of the new equipments ordered is that of a lighting plant for the city of Blue Island, Ill., including a 120-kilowatt Triumph dynamo, and a 225-horse-power Ideal engine.

CINCINNATI REPORT.

Conditions in the local machinery market have resumed their normal sway in a surprisingly brief time, considering the closeness of election excitement. As a rule, all establishments report generally improved conditions, and while orders have not yet begun to accumulate from the dealers, those that come in are for the better class of work, and are from all parts of the country alike, being principally domestic in character. A straw showing the tendency of the times is suggested in the way orders are running for special features in machinery, especially radial drills. The buyers of such are apparently determined to get the full value of their money and are sticklers for certain specific features that frequently makes it necessary to build machines specially for them.

The local machine-tool making concerns have not felt any effects of a rising market in material as yet. As a rule, all castings are ordered on a sliding basis, adjusted the first of the month.

The Bickford Drill and Tool Company reports a marked improvement in tone since the first of the month.

Dreses, Mueller & Co. have built some special machinery, one new heavy machine for the Rarig Engineering Company, of Columbus, Ohio, to be used in their new plant at that place. The machine is a 7-foot, full universal radial drill, 13,000 pounds in weight. The new Columbus concern in addition to the building of large engines has a department for the manufacture of gun carriages for the government.

Greaves, Klusman & Co. have been busier the past six weeks than for several months previous. Their output is for the most part of engine lathes and principally to fill domestic orders. Two good-sized machines are destined for Texas. This concern has recently finished its 19 and 22-inch swing engine lathe, which completes the third new pattern and one of 24 inches is in preparation.

President H. M. Lane, of the Lane & Bodley Company, has lately sent out from that establishment three out of four compressors ordered to be used in the great Robinson Diamond Mines of Johannesburg, South Africa. The machine sent a day or so ago has 20 and 38-inch by 48-inch steam and 20 and 34-inch by 48-inch air cylinder. The fourth and last order will be filled in two weeks. The Lane & Bodley Company report business booming on their line of Corliss and other engines, especially in the line of cotton-mill connections.

The Tudor Boiler Works are preparing to make improvements. Mr. H. Tudor, of this company, has lately been in the East making purchases of mill machinery. In addition to their new riveting plant, the company is to install at once another big traveling crane and a flanging pass all to be operated by hydraulic pressure. The Tudor Company has just received an order for a 1,000 horse-power water-tube boiler designed for a Big Stone Gap (Virginia) Company, of which E. H. Harper, a well-known Cincinnatian, is president.

The J. H. McGowan Company is turning out some big orders in pumps. A shipment to Cairo, Ill., includes a four-million-gallon compound pump, and one to New Castle, Ill., a three-million gallon, and to Gallatin, Tenn., two of one million gallons each.

The electric concerns producing power machinery continue to make big shipments of machinery of that class.

Celina, Ohio, has just closed a contract for a lighting plant which will cost in the aggregate $25,000. A large quantity of apparatus has been ordered from the Ft. Wayne Electric Works. The Arbuckle-Ryan Company, of Toledo, secured the steam-plant contract. The village of Leipsic, Ohio, has just contracted for a new water-works plant in which are to be installed three deep well pumps. These are to be electrically driven and the Ft. Wayne Electric Works are to install the generating apparatus and motors.

Report from the Bullock Electric Manufacturing Company and the Triumph Electric Company indicate business exceptionally brisk, and a conservative opinion estimates the volume this year 50 per cent. in excess of last, which will hold good with both companies named. Mr. Jacobs, of the Triumph Electric Company, in addition to this estimate, says that last year's business was over 100 per cent. in excess of any previous one. This company has just shipped to the Dayton Electric Light and Power Company, Dayton, Ohio, two 200-kilowatt direct-connected machines to be attached to a cross compound engine, both to be connected with the one engine. The Triumph Electric Company has made a very interesting installation in the shape of a lighting plant for the government boat, the steamer "Colonel MacKinzie." The boat has just been finished and put into active service and is said to be the finest equipped government vessel on the Mississippi River. The Triumph people have shipped to the Marmet Coal Company to be installed in their mines at Marmet, Va., a large generator with a costly switchboard to be used in operating their mines electrically.

The Cincinnati Edison Electric Company expects to put in service its new storage battery about December 1. This battery has a discharge capacity of 4,600 amperes on each side when connected to the three-wired system, and cost the concern $130,000. It is now being installed in their new building on Government Square.

Quotations.

NEW YORK, Monday, Nov. 12, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:

No. 1 X foundry	$16 25 @ $16 75
No. 2 X foundry	15 50 @ 16 00
No. 2 plain	14 50 @ 15 00
Gray forge	14 00 @ 14 25

Alabama Irons:

No. 1 foundry, or soft	15 25 @ 16 25
No. 2 foundry, or soft	14 50 @ 15 00
No. 3 foundry	14 00 @ 14 50
Foundry forge, or No. 4	13 50 @ 14 00

Bar Iron—Base sizes—For good refined brands on dock, 1.40c. upward, and for same from store, 1.70c. @ 1.80c., in an ordinary way.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery steel — Base sizes — From store, 1.65c.

Cold Rolled Steel Shafting—Base sizes —From store, 2½c.

Copper—Lake Superior, ingot in carloads, 16⅞ @ 17c.; electrolytic, 16⅝ @ 16¾c.; casting, 16½ @ 16⅝c.

Pig Tin—27.80 @ 28c. for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—Prime Western, 4.20 @ 4.25c., New York delivery.

Antimony—Cookson's, 10½ @ 10¾c., according to quantity; Hallett's, 9¼c.; United States, 9.10 @ 9.35c.; Japanese, 9c.

Store and Business of Schuchardt & Schütte, Berlin.

It will be remembered that in our issue No. 25, at page 578, I gave some account of the methods and of the work done by the firm of Schuchardt & Schütte, of Berlin, in introducing and selling American machine tools in Germany and other continental countries. Some of our friends misunderstood that article a little, or, rather, seemed to misunderstand the reason for publishing it, and thought perhaps we had some special incentive for "booming" the business of the firm referred to. We have no such reason; but it is a notable fact that every machinery man who goes from America to Berlin is sure to go, while in the city, to see certain prominent machinery houses that have exerted an important influence upon the continental trade in American tools. He is almost sure, for instance, to go to the store of Gustav Diechmann & Sohn, who are the sole representatives in Berlin of the Brown & Sharpe Manufacturing Company, so far as machine tools are concerned; that of De Fries & Co., who represent the Pratt & Whitney Company, and Schuchardt & Schütte, who represent so many American tool builders that a list of them would be tiresome. It is unnecessary to go over the reasons in detail why no machinery man would consider a visit to Berlin to have been complete unless it had included more or less careful inspection of these three establishments at least, but it seems to me that if every machine-tool man who goes there finds something of interest in these three places, many of those who for one reason or another cannot visit Berlin will find points of interest in such an account as we are able to give of them and of their methods of doing business. I spoke to Mr. Diechmann about the practicability of getting some photographs of his place, which is interesting in many ways. At that time it was not practicable to get them (although we may be able to do so later); but at Schuchardt & Schütte's such photographs as were needed to give an idea of what the store is like were readily obtainable; and as this is by far the largest establishment of its kind in Berlin—and, so far as I know, in the world—I trust that some account of it will prove interesting.

At Fig. 1 is a view of the front of the store-rooms in Spandauer Strasse. This will be seen to include five ordinary store-rooms, and this, together with the plans of the ground and second floors, Figs. 2 and 3, which have scales attached in both meters and feet, will give an idea of the magnitude of the Berlin house, which is the headquarters, and besides which there are branch houses in Vienna, Brussels, Cologne, Stockholm and St. Petersburg. The basement plan would be practically a duplication of Fig. 3; the entire ground area, including the courtyards, being available in the basement for storage and for the machine shop, an interior view of which is also given.

Messrs. Schuchardt & Schütte established their business in Berlin in the year 1880. Their first small office, at No. 9 Fischer Strasse, was exchanged for somewhat more extensive quarters in 1885, at No. 5 Molkenmarkt. The business, which until then had consisted chiefly in the selling of steel and small tools, was enlarged and extended by the addition of certain lines of machinery. The firm had at that time built up quite an extensive trade, not only in Germany but also in the neighboring continental countries, more especially Austria, Russia and the Scandinavian countries, Sweden, Norway and Denmark. The office and store then occupied were again found to be too small, and a small portion of the present premises in Spandauer Strasse was taken.

Germany was at that time forging rapidly ahead in the way of commercial and industrial development, and Messrs. Schuchardt & Schütte, who had from time to time taken and filled chance orders for one or the other American machines, were far-seeing enough to look into the future, and very soon recognized the importance of developing this particular line of business. It was with that object in view that Mr. Bernhard Schuchardt made his first trip to America, in 1890, after the business had again been removed to other quarters and considerably enlarged. But it was not without some difficulty that Mr. Schuchardt, after having visited a number of places in the United States, finally succeeded in convincing some of our people of the growing importance of Germany and other countries of the European continent as a market for American machinery and tools, and of the desirability of their making suitable arrangements with him, with a view to further developing and stimulating that trade.

However, some important business connections were made at the time with a few American manufacturers, and it was hoped that the results, if satisfactory, as Messrs. Schuchardt & Schütte felt sure they must be, would, in the course of time, induce others to follow suit. This expectation was soon realized to the full. Their orders were continually increasing in number and volume, and within a few years the business assumed proportions which commanded the attention of all who were interested in machine tools.

In 1893, during the time of the Chicago Exhibition, Mr. Henry Schütte, the other partner of the firm, visited the United States, accompanied by two of his men. They visited the principal firms and manufacturing centers, selecting everywhere the best of what they found available and adapted to their trade, placing large orders and at the same time establishing a number of new and important business connections. Afterward they made regular trips to the United States every year, until they finally found that the volume of their rapidly increasing business and the extent and multiplicity of their interests in this country made it desirable for them to establish, in 1899, an office of their own in the United States. This office was opened at No. 122 Liberty street, New York, and placed in charge of Mr. Daunert, who, with a staff of assistants, attends to the shipping and to all matters requiring attention on this side.

In the meantime Messrs. Schuchardt & Schütte, besides again and at various times

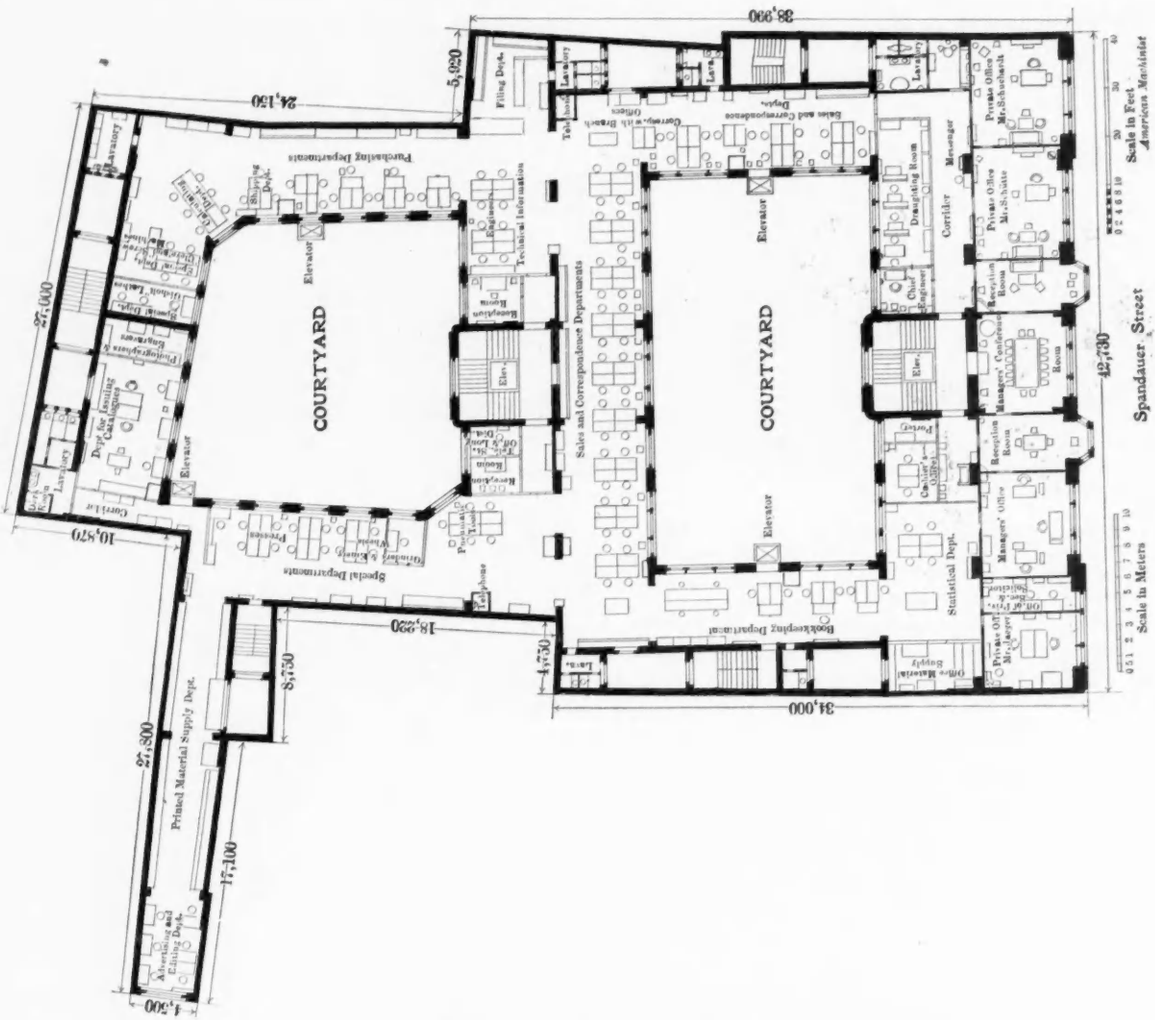


FIG. 3. PLAN OF GROUND FLOOR OF SCHUCHARDT & SCHUETTE'S STORE, BERLIN.

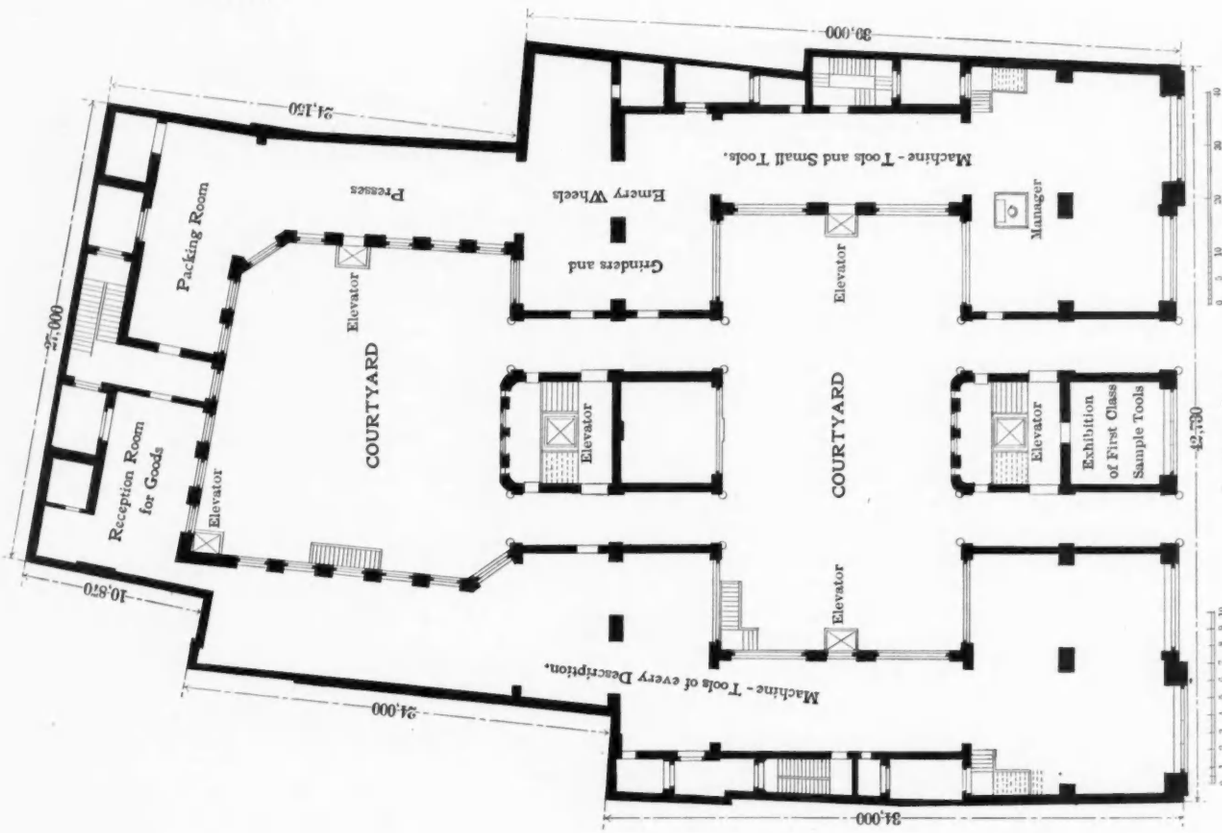
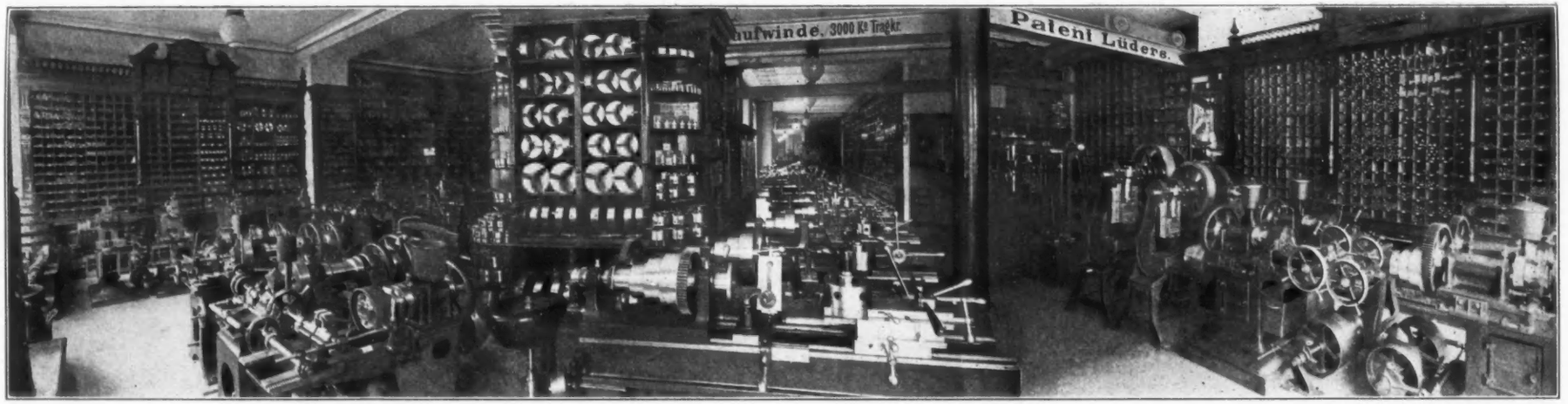


FIG. 2. PLAN OF SECOND FLOOR OF SCHUCHARDT & SCHUETTE'S STORE, BERLIN.



GENERAL VIEW OF PORTION OF INTERIOR OF SCHUCHARDT & SCHUETTE'S BERLIN STORE-ROOMS.

enlarging the stores and offices at Nos. 59, 60 and 61 Spandauer Strasse, opened other branch houses in various places already mentioned. The Berlin stores alone cover a ground floor area of about 41,900 square feet extending from the basement of the building to the third story, and the total ground floor area of all their stores, including that of the branch houses above mentioned, amounts to about 98,300 square feet, or something over two acres.

An enumeration of the machines to be seen in the store-rooms would be tiresome; it is sufficient to say that the display is very striking and impressive, and that everything a manufacturer can need is to be found here, from the smallest twist drill to a steam hammer; most of the machines and tools being so familiar to an American machinist as to make him feel quite as though a section of America had been transplanted and set down here in the midst of the German capital. The various photographs give a good idea of the way the show-rooms looked at the time of my visit. As far as possible the machines are classified and the various kinds kept together by themselves.

Between the two large stores on the ground floor, and fronting on the street, is a smaller room which has been fitted up as an exhibition of measuring tools, measuring machines, surface plates, gages and all kinds of articles and devices in this line. It is the most complete and attractive display of its kind I have ever seen. In the basement they keep large well assorted stocks of such articles as anvils, vises, etc.

A considerable part of the basement is also taken up by a completely fitted up workshop, with shafting and belts run by an electric motor, for practically operating and testing all kinds of machines and showing them in operation to customers. This department is one of the most interesting features of the place. In this workshop they practically demonstrate to the customer what the machine he intends to buy will do, and they have their skilled men who can show him on the spot how to do the work in the best and most approved manner. For this purpose they have certain machines ready belted up for work, such as automatic gear cutters, Hendey-Norton lathes, automatic screw machines, bevel-gear cutters, shapers, grinding machines, power hammers, etc. Any of these machines can be set to work at a moment's notice, stock being kept in them and men ready to operate them. It is obvious that nothing could be more instructive and convincing to a man who perhaps sees a tool of a certain kind for the first time. There are even gas furnaces for heating stock for the power hammer.

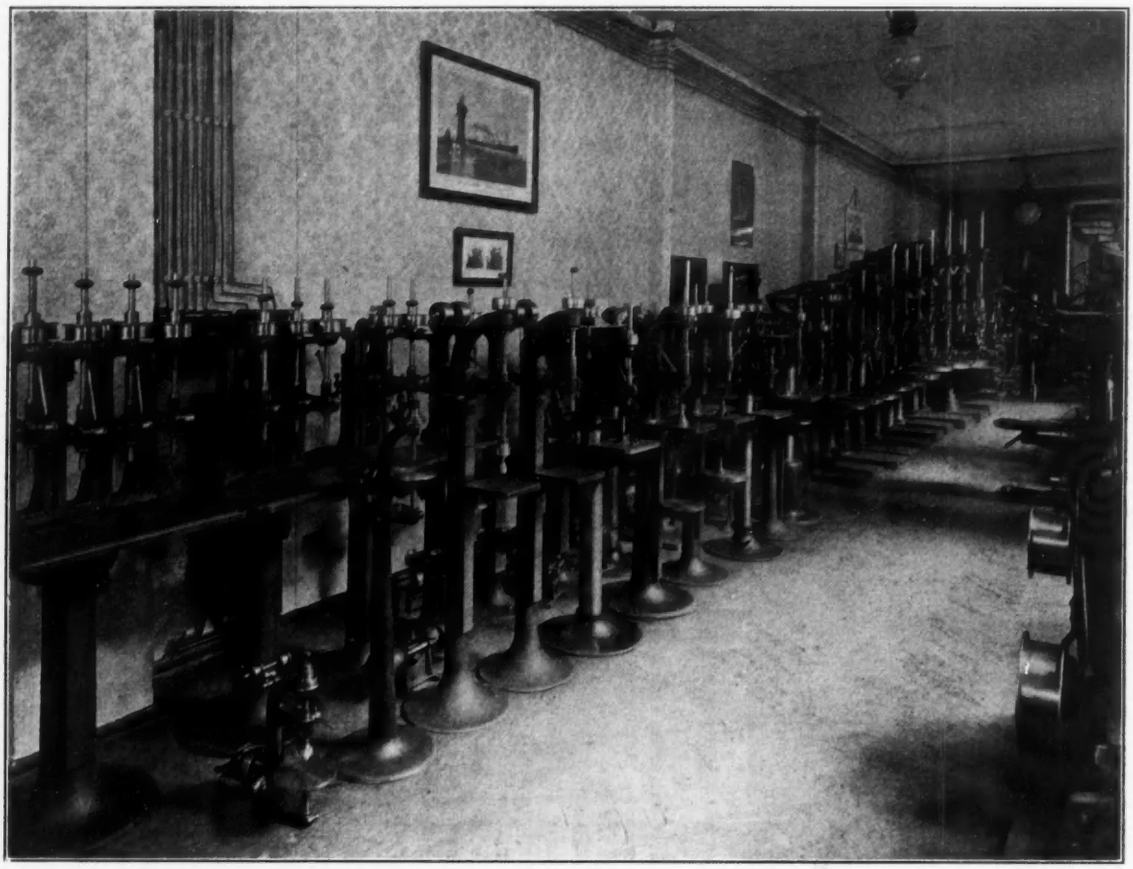
On the other hand, this workshop serves the purpose of enabling Messrs. Schuchardt & Schütte to test for their own information any new machine which they may be contemplating to bring into the market, and to thus form an intelligent opinion regarding it and as to whether they shall take it up or not; it being their object to push none but the very best make of machines of each specialty, and, after having once taken up the general agency for any such make, to refrain from offering or selling any competing machine in that particular line.

A part of this shop is fitted up solely for the pneumatic tools of the Chicago Pneumatic Tool Company. A 20 horse-power dynamo runs an air-compressor from which compressed air under a pressure of about 7 atmospheres is supplied to the different pneumatic tools. We see there a pneumatic hammer at work trimming the edges of a boiler plate, others upsetting rivets, pneumatic drills for capacities ranging up to 3-inch holes, a pneumatic rammer for molding purposes, a pneumatic casting cleaner, pneumatic hoists and jacks, pneumatic painting machines for spraying paint on large surfaces, etc.

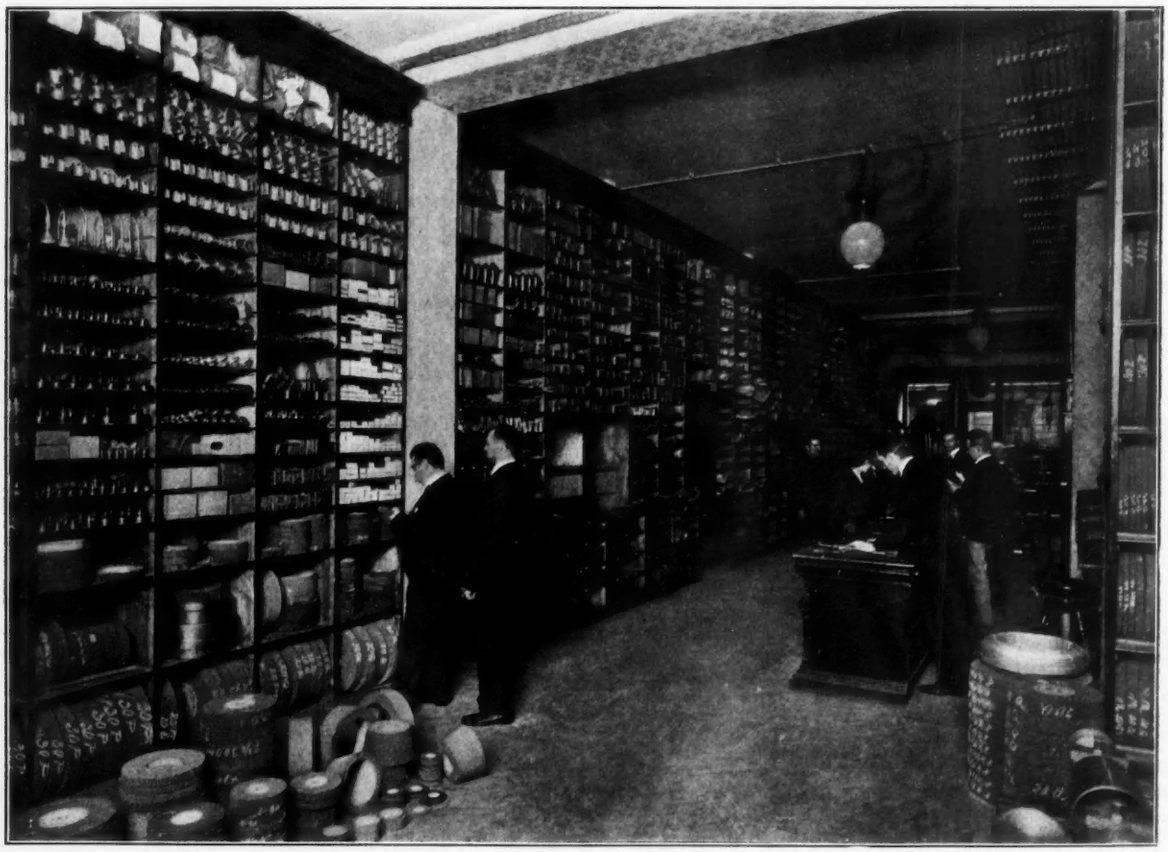
This specialty of pneumatic tools was taken up by Messrs. Schuchardt & Schütte only a few years ago, and has since been developed into an important line of their business largely through their pluck and enterprise in practically demonstrating the machines to customers and teaching them how to use them. Students from the technical schools also occasionally visit this shop in a body to inspect the machines and familiarize themselves with them and also with the beer and cigars which German custom requires shall be "on tap" on such an occasion.

In the second story of the building there is a large storeroom for smaller machinery, such as drill presses, a full line of bicycle machinery, etc.

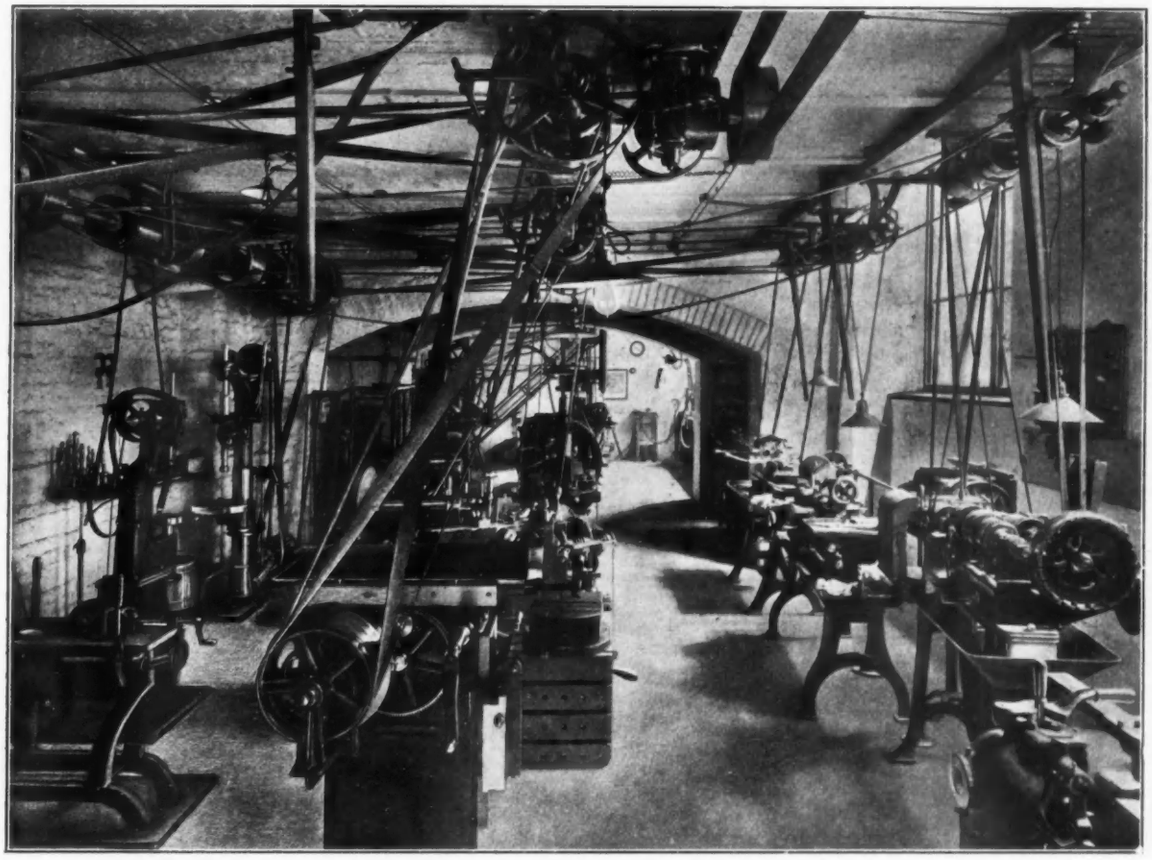
Another special department there is occupied by a thoroughly equipped tool-



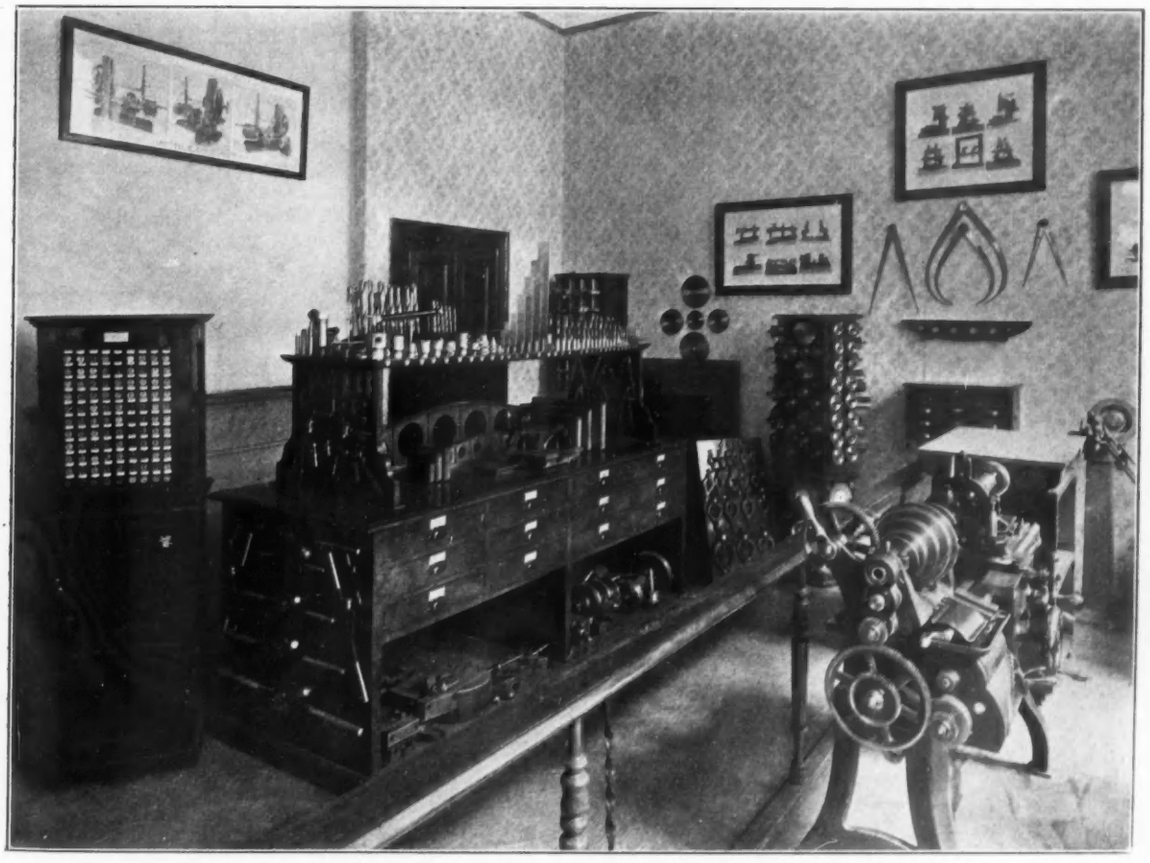
VIEW IN DEPARTMENT FOR DRILLING MACHINERY—SCHUCHARDT & SCHUETTE'S BERLIN STORE.



STORE-ROOM FOR SMALL TOOLS, ETC.—SCHUCHARDT & SCHUETTE, BERLIN.



WORKSHOP IN BASEMENT OF STORE—SCHUCHARDT & SCHUETTE, BERLIN.



TOOL-ROOM—SCHUCHARDT & SCHUETTE'S BERLIN STORE.

SHOW-WINDOWS—SCHUCHARDT & SCHUETTE, BERLIN.

room. Such tool-rooms as we have had in America in nearly every manufacturing establishment of any consequence for many years were very little known in European countries ten years ago. Messrs. Schuchardt & Schütte can claim for themselves the credit of having made many of the manufacturing people acquainted with this important improvement. They went about this in their characteristically thorough and energetic way, and the tool-room which they had fitted up at their establishment by an expert in this line, whom they engaged from the United States for the purpose, has proven an immense success. It has induced many manufacturers to get acquainted with and to adopt in their works this important improvement, and large numbers of complete outfits have thus been sold, Messrs. Schuchardt & Schütte furnishing the plans, drawings, etc., and all information required in any special case.

On the second floor above are the main offices of the firm with all the numerous departments and a veritable army of clerks, engineers, draftsmen, assistants, etc. The offices extend along the entire width of the street front of the building, then back as far as to the end of the two large courtyards which separate the two wings of the building, and thence a considerable length towards the left, with the end of this extension facing another street. All the offices are elegantly fitted up in the most modern style and equipped with all the latest improvements for facilitating the transaction of business. Division of labor and responsibility has been carried out in a most ingenious and systematic way, so that, in spite of the enormous volume of business requiring to be attended to, and in spite of the great variety of technical details, wants and personages to be dealt with every day, the entire system operates smoothly and in the most thorough manner, every order being executed and every inquiry fully answered without unnecessary delay.

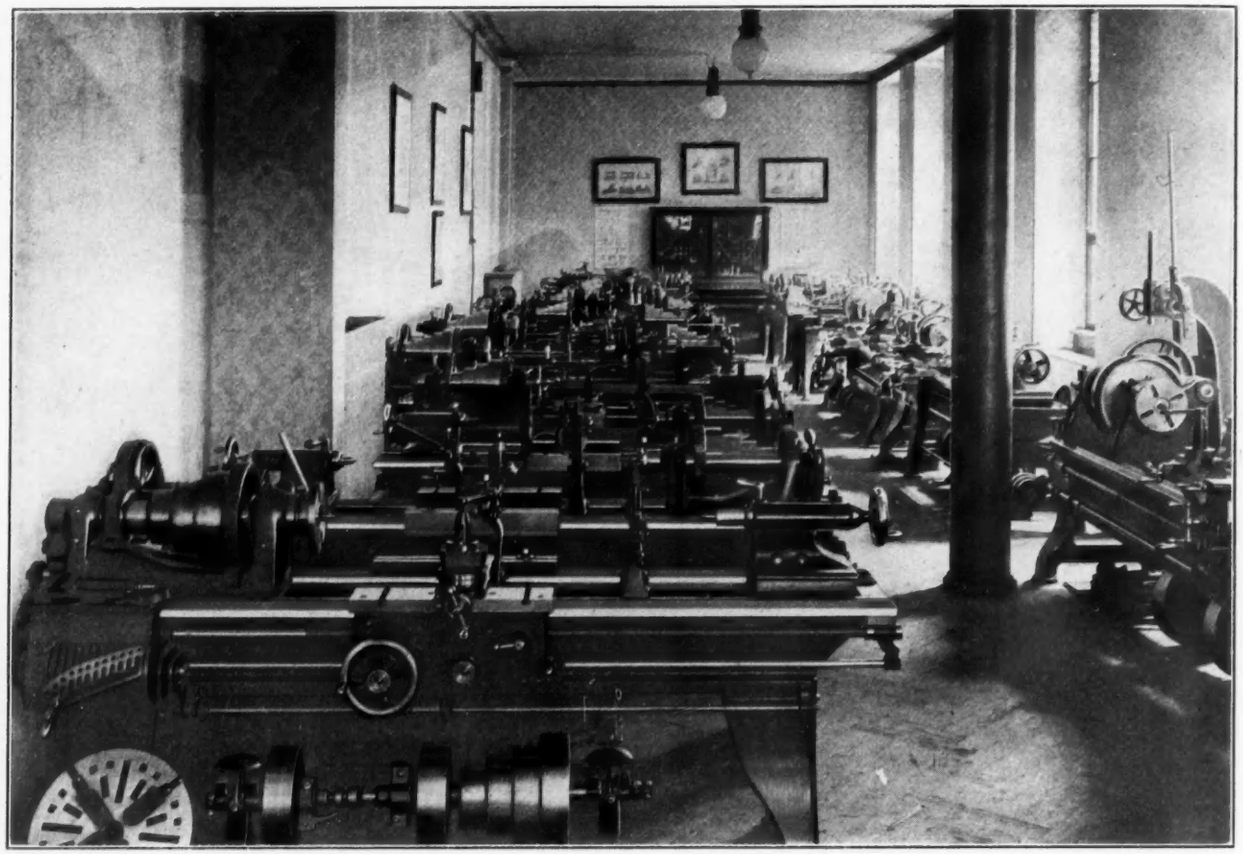
The territory worked from the main office in Berlin embraces all Germany, Switzerland, Italy, Spain, Holland, Denmark, and the colonies, whereas the other European countries are taken care of by the branch houses in Vienna, Brussels, Stockholm and St. Petersburg, the branch office in Cologne having been established only to assist the Berlin head office for the western part of Germany.

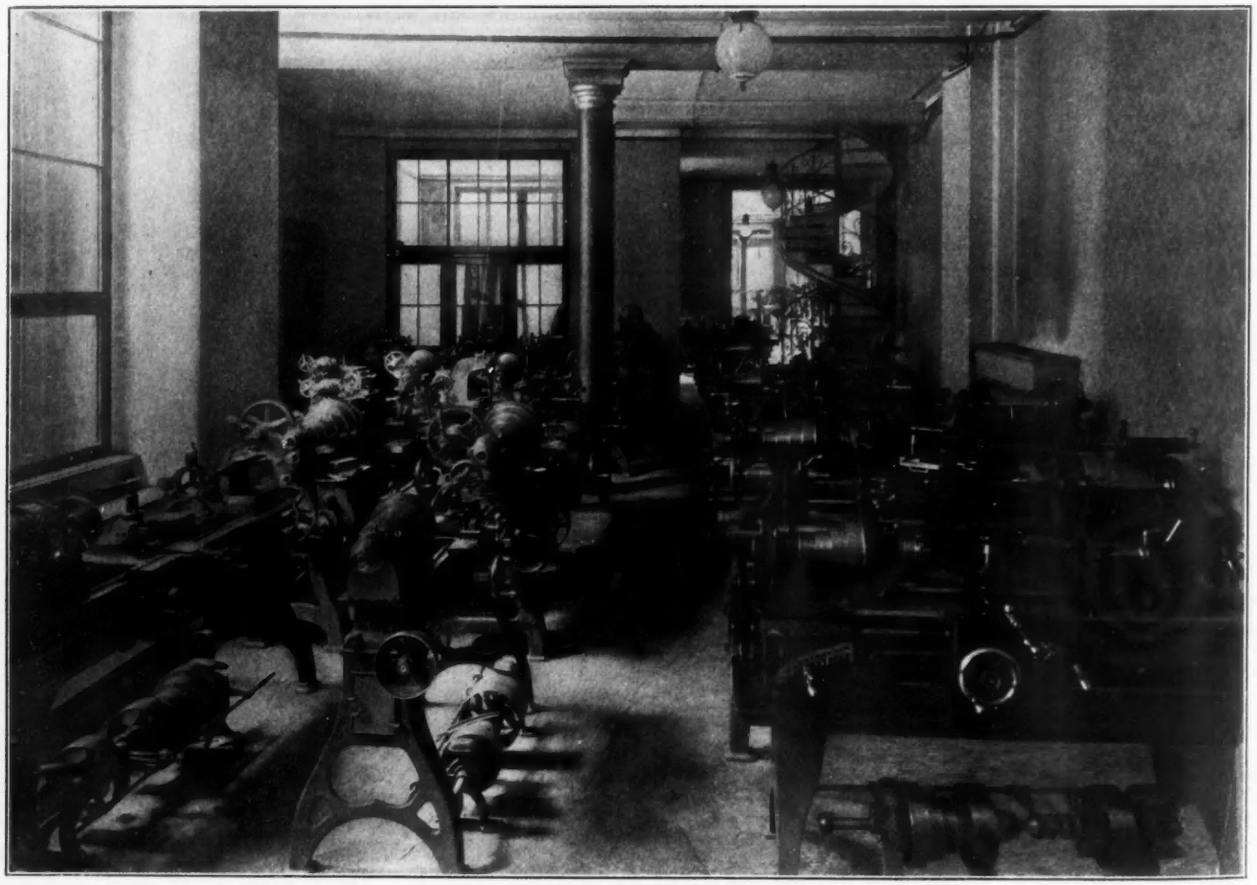
In all these branch houses large stocks are continually kept the same as in the Berlin establishment, but not of such large extent, of course. Still, all these stocks taken together represent a very respectable aggregate value. To this must be added the stocks which Messrs. Schuchardt & Schütte keep warehoused for distribution and reshipment in the free harbors of Bremen, Hamburg and Antwerp, exempt from duty until introduced into the open market in Germany or into the other countries of destination.

From the Berlin house and from all the branch houses a large number of traveling salesmen are continually on the road in all the different countries. They are all select men who have more or less gone through a thorough training and have, so far as possible, acquired a practical knowledge of the details of the machinery they are selling, and whenever any questions of detail arise which they find themselves incompetent to answer, they have at their disposal the knowledge and practical experience of a trained staff of engineers and specialists at the home office, from whom the necessary information for the customer can be obtained at short notice.

In this connection I may mention a feature of the business which particularly struck me in view of what we are accustomed to say regarding the limitations of machinery-selling agents—*i. e.*, that, while they are all right for what are known as the standard tools that are more or less familiar to nearly all of those who may be thinking of buying them, special machines are different, and the special knowledge of the machines themselves and of the work they are intended to do, together with the machines or processes they are intended to supersede, cannot be commanded by the general selling agent. Generally speaking, this is undoubtedly true, and is of course true of any selling agent who does not adopt means to overcome the difficulty. How this has been done by the firm in question can be best illustrated perhaps by the manner in which they have taken up the sale of the presses made by the E. W. Bliss Company. In going through the place with the senior member of the firm, I noticed a department which seemed to be set aside for this business solely. In a case on the wall and in drawers were specimens of work that had been done on various presses, and with dies supplied to go with them, while all the literature and equipment of the department related only to this one thing—presswork. Upon inquiry I found that the man in charge of this department, who was originally a mechanic, had made himself a specialist in this work for the express purpose of conducting the business. To this end he spent some time at work in the Brooklyn shops of the builders of the machines and made himself well acquainted with the methods of doing the work and with the special branch of it which consists of the art of recognizing a job which is possible or practicable to be done by a punching or drawing operation; convincing the prospective customer that it is practicable and that it will pay to do it so; and finally, designing, making and starting to work the special tools, dies, etc., that are required. I talked with this man about his work, and found him to be enthusiastic about it, spending his time partly in the office and partly in the factories of customers, looking after work suitable to be undertaken by press operations, or smoothing over the difficulties which in Europe, as well as in America, sometimes arise, and are especially liable to do so with tools of a different nature

SAMPLE-ROOM FOR MACHINISTS' SMALL TOOLS—SCHUCHARDT & SCHUETTE, BERLIN.





VIEWS IN DEPARTMENT FOR LATHES—SCHUCHARDT & SCHUETTE'S BERLIN STORE.

from any that have been used in the shop before. A slight variation from the above outlined plan is pursued in the case of the machines of the Gisholt Company. These also are, of course, special in their nature. That is to say, a large proportion of them are purchased for doing certain work which is carefully considered beforehand, and usually has tools of a more or less special nature made for it. In this case an officer of the company, Fred. A. Johnson, has spent several years on the ground helping Messrs. Schuchardt & Schütte to develop the business. Though he is much of the time away from Berlin, his headquarters are in the Berlin store, where he has a desk, and he not only is thus enabled to act as the expert in Gisholt lathe matters, but he knows by personal observation just what is going on, and is thus enabled to steer clear of the misunderstandings which sometimes arise with manufacturers who are not upon the ground, and who may be inclined to pay a little too much attention to rumors of various kinds that may possibly have their origin among competitors.

At the bottom of the second-floor plan, Fig. 3, it will be noticed that a room in the center of the front of the building is marked "Managers' Conference." In this room, at about the noon hour of every day, the heads of all the different departments meet and here are presented all the matters which have arisen since the previous day's meeting that are of general interest, or that may have a bearing upon the course to be pursued by any others besides the man to whose department the matter in hand may especially relate. A member of the firm presides at these meetings, and their effect in promoting a thorough understanding of the policy of the firm, and in placing in possession of the various responsible men of the establishment the knowledge that enables them to act intelligently, and in accordance with that policy, is very highly spoken of by the members of the firm. Questions brought up at these meetings can be at once discussed by all who have anything to do with them, and the decisions made with regard to them are at once known to all whose course might be in any way affected, so that by this plan very many things are done intelligenly and carried through with entire success that might not be so well conducted if a portion of those acting upon them were doing so with incomplete knowledge or perhaps erroneous conceptions. In going about the place one is sure to be impressed by the air of good order and system that pervades it; nothing drifts, or is left to take care of itself; nothing is nobody's business because it is everybody's business, but the work is divided and subdivided; some one person being responsible for any minute detail of it that may be mentioned. I noticed that the window displays of small tools and the arrangement of such tools in the room devoted to their exhibition were particularly fine—arranged not only so as to be convenient for customers and salesmen, but in such a way as to form pictures or designs that were harmonious and very pleasing to the eye. Speaking of this matter to Mr. Schütte, he said it was due to a man they had in their employ, who began as a laborer in the shipping room, helping to pack goods. He developed an aptitude for tools—soon learned to distinguish them and to be intelligent regarding them and their uses, and it was noticed that in handling them he naturally arranged them in orderly and systematic fashion. He finally had work to do in connection with the show windows, and it was found that he was a natural artist in arranging tools to make the best possible display. He was encouraged in this, and now does little else but see that the show windows and the small-tool show-room are kept in perfect order and the tools displayed in the most effective way. All the sample tools exhibited there are rearranged every week, and every tool is as bright, clean and free from dust as when it left the hands of the man who put the finishing touch upon it. Not only does he do this work in Berlin, but he visits the branch houses and rearranges the displays, at the same time giving lessons to the local men in the art of effective arrangement. Photographs give a faint idea of the beauty of these displays, but some conception of them can be obtained by the views given.

It ought to be apparent from what has been shown that the firm in question has exerted, and still exerts, an important influence in the development of continental trade in American machine tools, and it is certainly to be hoped that their business will continue to grow. It does not detract in the least from the good work done by others in this field to give Schuchardt & Schütte all the credit that is due them, and as opportunity offers we may give more specific accounts of some of the other establishments. F. J. M.

Necromancy of Naval Gunnery.

"How in the world the gunners on our big battleships ever manage to land a shell within a mile of the thing they are shooting at has been a mystery to me ever since I saw a piece of heavy ordnance actually turned loose," said a man from California. "I was on the 'Oregon' during some range tests off Mare Island, shortly after the ship was placed in commission," he continued, "and the executive officer, who was an old schoolmate of mine, took me into the after turret to show me how the big guns were sighted. The man who does the aiming stands on a little platform at the rear of the breech and looks through a telescope fastened above the barrel. Two wires cross each other at right angles in the far end of the glass, and the place where they meet must be brought in line with a lance-shaped sight at the muzzle of the gun and also with the object aimed at, which in the case to which I refer was a canvas screen, 16 feet square and 1,400 yards distant. Now, that would be hard enough to do on dry land, because every slight shift of the telescope meant the simultaneous shifting of several tons of cold steel by means of a complicated system of wheels and levers; but on board a moving ship, rocking up and down on the waves, the difficulties are something appalling.

"I squinted through the instrument, and all I could see was a circular patch of ocean whirling criss-cross over the field of vision, like a magic-lantern picture with a bad case of St. Vitus' dance. Once I caught a glimpse of something white, that shot across the circle as swiftly as a swallow and was gone before I could say boo! That was the target, on which the gunner was supposed to draw a bead! I stepped back in awe, while a good-looking young sailorman took my place, gave a couple of hand-wheels a few sharp turns right and left, and then, all of a sudden, pressed something like a telegraph key. I thought the whole universe had broken loose at the foundations, but it was only the gun going off, and the shell carried away one entire end of the white canvas target. How the good-looking young sailorman got his aim I don't pretend to say. It seemed like a piece of pure necromancy. The men behind the guns are, without a doubt, the greatest sleight-of-hand performers in the world. Herrmann simply isn't in it with them."—New Orleans "Times-Democrat."

One of the latest things in the machinery line is an auto-mowing machine, *i. e.*, an internal-combustion-engine-driven mowing machine. The McCormack and the Deering companies, of Chicago, both exhibit them at Paris and "Engineering" of London, in describing one of them, closes by saying, "Whether a petrol engine in a wheat field will be welcome to farmers remains to be seen." From this we might judge that in England mowing is done in wheat fields; but we don't do that here, and by the time the mown grass in a meadow is dry enough to burn very readily we expect the "petrol" engine to be somewhere else. A curious feature of the machine is that with a high-speed driving engine mounted upon it, the power for the cutter bar is taken from the supporting axle, as in a horse-drawn mower; that is, the speed of the engine is first reduced to that of the supporting wheels, and is then increased from that to the speed required for the cutter bar. We have too much respect for the abilities of the designers of agricultural machinery to speak dogmatically, but this certainly seems a left-handed arrangement. It may be due to the use of old patterns in making an experimental machine, or to the designer's mind getting in a rut. We venture to predict that the design is not final.

Mold Construction for Crayons and Lead Balls.

BY JOSEPH V. WOODWORTH.

Fig. 1 shows a face view of a mold for pencil crayons. As will be seen, it was made in two parts, and produced twelve crayons at once. Two castings *A* and *B*, 6 inches wide by 7 inches long, with lugs on one end of each for the hinge, were planed all over, with care to get as smooth and true surfaces on the faces as possible. The castings were very close-grained and totally free from blow-holes. After they were planed they were scraped on the sides on which the molds were to be, until they were as near true as possible. The lugs or hinges were then machined so that *A* fitted within *B* snugly. These were then clamped together and the holes drilled and reamed through the lugs for the pins *D*, which were driven in. The plates *A* and *B* were then held in the vise and milled through one side, leaving a rib on the side of each, as shown at *C C*, and a depression *R* between them. While they were still together the centers for the twelve molds were laid out and prick-punched.

The pins *D D* were then removed and the plates separated. We now had a center mark on the face of each plate for each of the twelve molds. The plate *A* was then strapped on the table of the miller dead square, and a line was struck from each center across the plate. A convex cutter, of 1-16 inch radius, was then used, and, starting at the center mark, was run along the line on the face to within ¼ inch of what was to be the total depth of the mold. This was done on all of the twelve centers, and the other plate was milled likewise, so that when the pins *D D* were inserted and the plates closed and clamped together there were twelve holes, ⅛ inch in diameter, straight through the center of them, or a half of a ⅛-inch circle in each plate.

The plates were then stood with the side *c c* up, and a drill 1-64 inch under the final size, and extra long, was run down through each of the ⅛-inch holes to within ⅝ inch of the bottom, the ⅛-inch hole in each keeping the drill perfectly central. A special reamer, of the shape shown, was then made and let down into the hole left by the drill, and by feeding down very slowly a smooth, round hole was made with the shape of the point in the bottom. All the twelve holes were gone over several times, until the exact depth was reached in each. The mold was then opened, and all the dirt and chips were cleaned out. It was then closed and reclamped, and, after some lead had been heated, several pieces of 3-16 inch drill rod which had been roughed all over were inserted, one in each of several holes, and the metal poured around them. When they were cool the mold was opened and the lead forms were withdrawn, thereby furnishing several good laps. The laps were run at a high speed in the drill press, using a generous amount of oil and emery, and the holes, or molds, were lapped and polished to a nice, smooth finish. The plates were then opened, and after being well cleaned with benzine there were seen twelve perfect semi-circular grooves of the size required in each plate, with dead-sharp edges that would leave no fin on the work. The pins *D D* were then eased a little, so that the mold could be opened without difficulty.

The next thing to be done was to make the latch *F*, shown in Fig. 4. This was made of ¼-inch flat steel and fastened to the plate *A* by the shoulder screw. A small stud was let into *F* for a handle *H*. The spring *I*, of stiff spring steel, was made and fastened so as to keep a strong tension on the latch *F*. The lock pin *E* was then made and hardened and inserted in the plate *B*, so that, in order to hold the two halves of the mold fast and snug, the half *B* was brought down sharply on to A, and the pin *E*, striking the latch *F*, it was forced back until it snapped over the pin, thereby locking it, which proved a

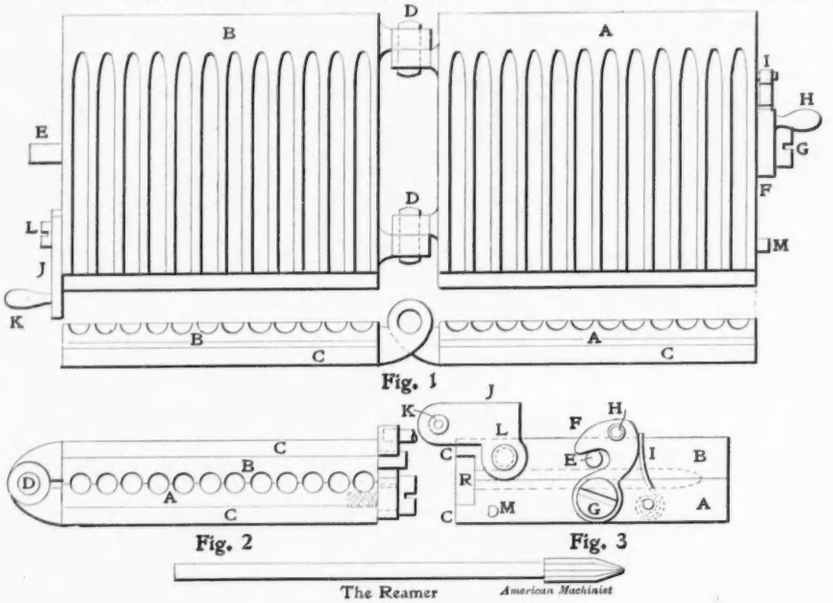
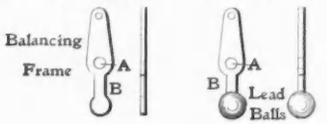
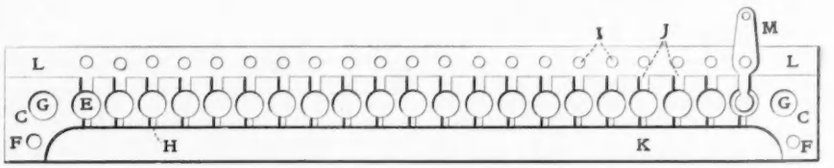


Fig. 1

Fig. 2 Fig. 3

MOLD FOR CRAYON PENCILS.





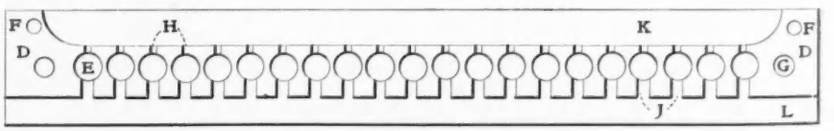


Fig. 4

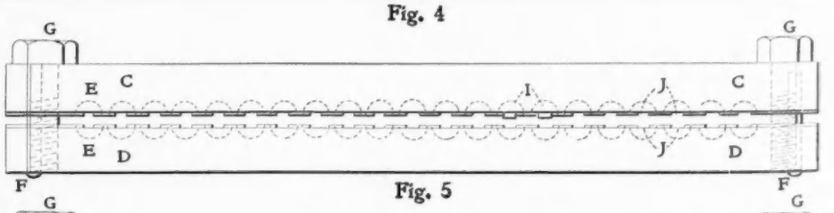


Fig. 5

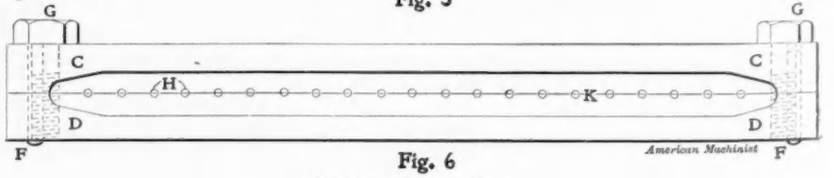


Fig. 6

MOLD FOR LEAD BALLS.

simple and reliable hold and was quick to manipulate. The swinging plate *J*, for closing the channel *R*, was then made of flat, cold-rolled steel and worked out and finished to the shape shown, with a small handle at *K*, and swinging on the screw *L*. The stop-pin *M* was let into *A* and filed off so that the plate would swing over and rest on it, thereby closing the channel and preventing the liquid metal from running out. The other end was closed likewise, and the mold was then complete, and produced a nice, smooth crayon, without the trace of a fin or a lump on the entire surface, and a slight shrinkage in them after they were hard allowed of their easy removal.

In Fig. 4 is shown a mold for casting a lead ball on to a sheet brass frame, as shown at *A* and *B*. This was used as part of a balancing mechanism, and it was necessary to have the balls all exactly the same weight and size, and in the same position on the frame. The mold used is shown in three views. Fig. 4 shows an inside view of each of the two sides; Fig. 5 shows the bottom, and Fig. 6 the top. The two halves of the mold were castings, and were planed true all over to the same size, with one smooth side. After being scraped a bit in order to true them, one of them was held in the milling vise, with care to have the vise true and the work down solid. Then the butt mill was held in the small chuck and the table was moved until the mill, while running, just touched the end of the casting at *C;* the table was then moved outward and moved along a certain number of thousandths of an inch (and a memorandum made of it) for the first hole of the mold. Care had been taken to have the butt mill to a perfect half-circle of the size required. The work was then fed up against it and the mill let in the desired number of thousandths, or to the depth of exactly half the diameter of the mill. The screw dial graduation was then noted, and the work brought back and moved along for the next hole, and so on until the twenty-one halves were finished.

The other side *D* was then held in the same manner, the mill set and fed in the same number of thousandths as before, and then each one milled to the same depth as the others. After this was done, the piece was removed, and two brass balls exactly the same diameter as the molds were turned up and finished, and one inserted in the last hole in each end of the plate *C*. The other plate *D* was then placed on top, thereby locating the half-molds perfectly true with each other. A hole was then drilled at each end and reamed, for the dowel-pins *F F*, which were made and driven into *C*. The holes in *D* were eased so that *D* would go on the pins nicely. This proves a simple way of locating the molds exactly true with each other. The holes for the cap-screws *G G* were then drilled, and the two sides *C D* held fast together. A cutter just the thickness of the stock used for the frames was then run straight through at *L*, where the two pieces *C D* lay together to the depth shown. *C* and *D* were then separated, and the centers laid out for the holes opposite each mold, as shown at *I I*. The holes were then drilled about ¼ inch deep, and, to allow the pins to be driven in to hold the frames in place, as shown in the upper right-hand mold, each of the sides was then set up in the shaper and a tool just the width of the frame at *B*, centered with the holes *I I* opposite each mold, and a channel planed into the center of each mold, as shown at *J*, to the same depth as *L*. The idea and form are shown clearly in Fig. 4. The parts *C* and *D* were there put together and the screws *G* tightened and the holes for the lead to run into the molds drilled, as shown at H, using a No. 40 drill and running into the center of each mold, leaving half a hole in each. The sides *C* and *D*, still together, were then held in the miller vise, and an angular cutter was used to mill a trough for the metal at *K* to the length and width shown, and, for depth, to within 3-32 inch of the molds, leaving the small channel, as shown. The two sides were then separated and the face polished with fine emery cloth and all the burrs removed, being careful to leave the edges of the molds sharp. The small pins were to be made and driven in to the holes *I*, and then filed down to just the thickness of the frames, and the top slightly rounded. A frame was then entered on to each of the pins, as shown at *M*, thereby holding them all central, and the channels *J* keeping them steady. The two sides were then put together, the cap-screws *G G* tightened, and the mold being complete, it was held in the vise. The lead was heated to run freely and poured into the trough *K*, and running through the small holes *H* into the mold after the metal had set, the screws were loosened and *D* lifted off, the casting removed and the balls chipped off at the small neck caused by the holes *H*, leaving twenty-one balancing frames with a perfect ball at the end of each, all exactly the same. The one thing necessary in making a mold of this kind is a perfect mill and accurate spacing, and the work resulting will show no fin. The machine used was a Cincinnati universal, and it was surprising how dead accurate the spacing was, there not being a difference in any of the work produced, either in size or shape.

The Latest Designs with Some Applications of the Walker Magnetic Chuck.

It is now more than four years since we first illustrated and described the Walker magnetic chuck and some of its various applications. The device was so self-evidently useful that it would have been a wonder indeed if it had not found appreciation and extensive adoption. The business of its manufacture has healthily grown, and the designs and arrangements have developed to meet the conditions of practical work in the shop. The chuck, of which we now present an illustration in Fig. 1, is the result of an effort to standardize and combine the features which have proved most valuable. Where two distinct styles of holding faces were formerly made, one for holding work by one side and the bottom, and one for simply holding work down, these are now combined in one, and a chuck is produced which exerts practically an equal force over the entire surface, not only holding down a large number of pieces, but also exerting a strong side action, as in holding work against a side rest for squaring.

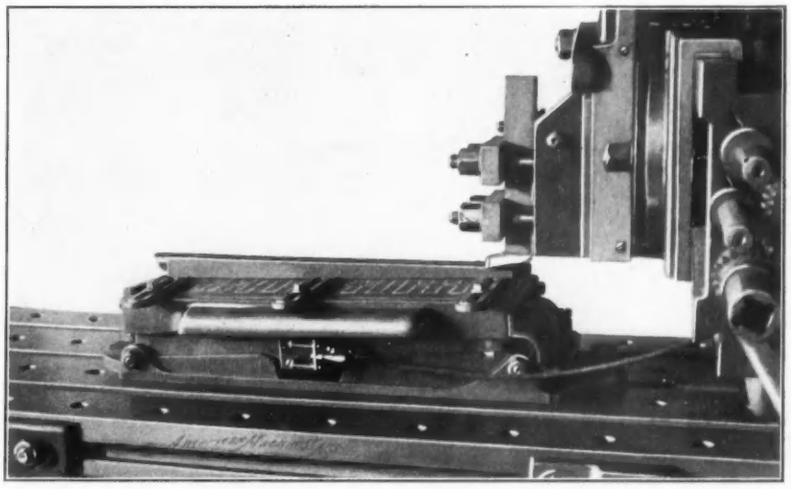


FIG. 1. THE MAGNETIC CHUCK HOLDING TAPER WORK ON THE PLANER.

As shown by Fig. 1, the chucks are made to be used in a taper shoe when so ordered. A hole is drilled through one end for the hinge bolt, seen at the left, and a graduated scale is planed in the front side or end of the chuck to indicate the taper per foot. The taper shoe consists of a channelled piece, planed to fit the chuck closely at the sides, through the side cheeks of which are drilled two holes,

one for the hinge bolt, which also has a clamping action, and a hole at the opposite end for the clamping bolt, which holds the chuck firmly at any angle after it has been adjusted by the elevating screw threaded through the detachable end shield shown at the right. By removing the shield and the hinge bolt, the chuck can be taken from the shoe and can be used as a plain chuck directly on the platen. The bottom of the chuck and also the bottom of the taper shoe are grooved for a tongue.

All chucks are also now made with detachable overhanging tops, instead of detachable bottoms as heretofore. This results in a more rigid design and provides for attaching any special face at pleasure, or to have the face renewed, should it become necessary. The chucks are now made with square ends instead of rounded ends as heretofore. By removing the overhanging top, chucks may be arranged in series, so that any desired length may be obtained, the chucks being designed with adjacent sizes in pairs, as far as cross-section is concerned (the lengths varying), so that a combination can be selected to fit platens of various lengths.

The chucks are made to be used on either planer or surface grinder, and while the greater demand has heretofore been from the surface grinder, the planer would seem to be the field of greatest utility, where all parallel work, not too small in size, can be held with ease.

The chucks here referred to constitute the regular standard line of flat-surface chucks; but to still further cover the field for magnetic chucks for all purposes, there has recently been brought out a special chuck, hung in bearings at each end and graduated for bevels of any angle. This chuck is illustrated in Figs. 2 and 3, Fig. 2 showing the chuck adjusted in a horizontal position for grinding the square edge of a triangular piece, and Fig. 3 showing the method of beveling. It will be noticed in Fig. 2 that the proper angle (horizontally) is set by the adjustable straight-edge at the left. The slotted side rest on the near side is for the reception of slotted fingers (not shown), to further assist in setting horizontal angles. In Fig. 3 the work rests against a knife-edge bevel on an adjustable side rest adjacent to the emery wheel. This enables the operator to grind a bevel nearly to a sharp edge. The chuck is also used for surface grinding or flat work, with the holding face of the chuck in a vertical plane. The chuck is graduated in degrees and is 10 inches long by 4 inches wide. There is a binding post at each end for the electric connections, and a switch also is attached to each chuck. The holding brackets are grooved for a tongue, so that the chuck can be fitted to any surface grinder, it not being designed for planer use.

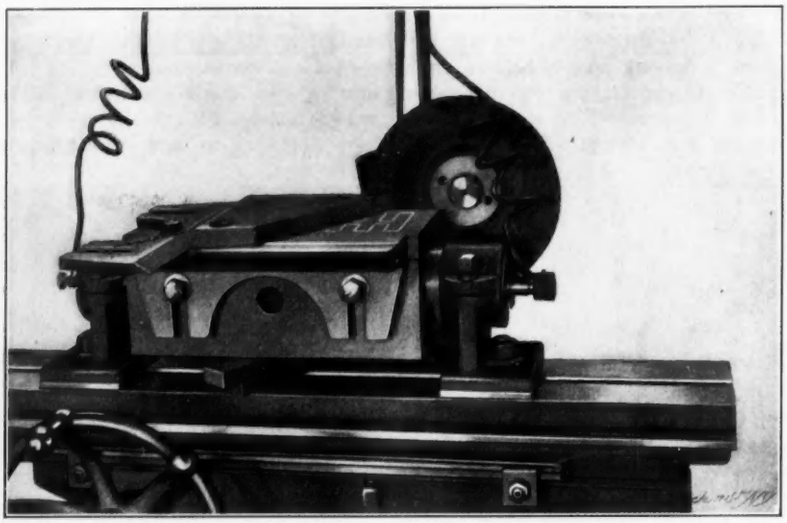


FIG. 2. MAGNETIC CHUCK HOLDING TRIANGULAR PIECE FOR GRINDING THE EDGE.

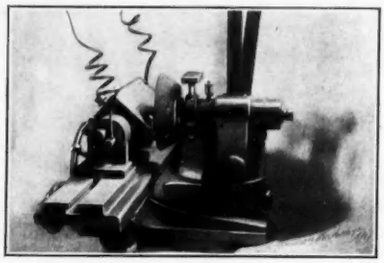


FIG. 3. MAGNETIC CHUCK HOLDING WORK FOR GRINDING BEVEL.

Extending the Range of a Boring Mill.

Various methods and devices for doing work in lathes beyond their normal range are of common knowledge and are frequently practiced, but the doing of work in boring mills beyond the capacity for which they were built is less common, and the accompanying half-tone showing such a piece of work in progress will be of corresponding interest to our readers.

We are indebted to the General Electric Company, in whose Schenectady works the job was done, for the photograph from which the engraving was made. The work being done is the boring in the ring frame of an electric generator of a seat for the support of the commutator brush rigging The ring frame was supported on the floor of the shop in a position concentric with the boring mill table. The housings and upper works of the mill were entirely removed, and some stiff bars bolted to the table carried at their ends a cross-rail and tool box taken from a convenient planer. The mill used was of the extension type, of 14 to 20 feet swing; the diameter of the piece of work over all was 29 feet 7 inches, and the extreme diameter of the cut taken was 26 feet. A scale standing upon the floor, at the right of the work, gives an idea of the general dimensions. The numbers upon it indicate feet.

Letters from Practical Men

The Working of Platinum.

Editor American Machinist:

As platinum is getting to be used more extensively, and as we frequently hear queries as regards its peculiarities, infusibility, etc., it has occurred to me to mention a few facts that I became aware of while in the service of the Bakers, of Newark, N. J., who, I believe, are to-day the only people who work platinum to any considerable extent. Their immense rolling mill for sheet metal has a width of nearly five feet, and they are fitted up in the most perfect manner for the production of platinum wire for electric lamps, and also for the production of large vessels for chemists' use. Some of these large stills weigh as much as 1,000 ounces and they are mostly used for the purpose of concentrating oil of vitriol.

When I first entered the service of this company, I was surprised to see this valuable metal worked in large ingots, very similar in size to brass and copper ingots, hammered, drawn, rolled and worked just like other metal, apparently. But what a peculiar metal to work! To the uninitiated who are permitted to take a view through the works, it will seem odd indeed to see a man annealing a piece of stock, say about .004 inch thick, blowing the blast fully open on the flimsy little piece, which must be held in such a manner that the force of the blast will not blow it away, and there it will quiver and tremble in a white heat, holding its own in its infusibility, and you can blow and blow the hottest blast of the ordinary gas upon it without noting the least change in the piece. The result, however, of such a blast will be an annealing of the metal.

I had no opportunity while there to attempt drawing up work by the press, and cannot say whether the peculiarity of the metal will permit such an operation. Some of the pieces were dropped up; it,

however, was slow work, as the metal seemed to be unable to stand any breaking over and had to be "hammered" up, so that numerous operations were necessary; in this instance, however, only very thin stock was used.

As it is claimed that spinning opens the structure of the metal and makes it more susceptible to the attack of acids, most of the work is found to have been bright hammered. That which is spun must be very carefully worked to keep structures intact. There must be no "open stretching," no "thickening in" of the stock, as it will certainly disturb the texture or strength of the stock more or less. In spinning the greatest care must be exercised that the platinum does not bite the burnisher or the chuck—if the chuck is of metal—and tear steel away from the tools, and thereby making the platinum worthless for the job intended, as the imbedded steel must come out, and that can only be by a refusion or by some chemical process that will destroy the steel. I found that a rood burnisher could be used with good effect on some work.

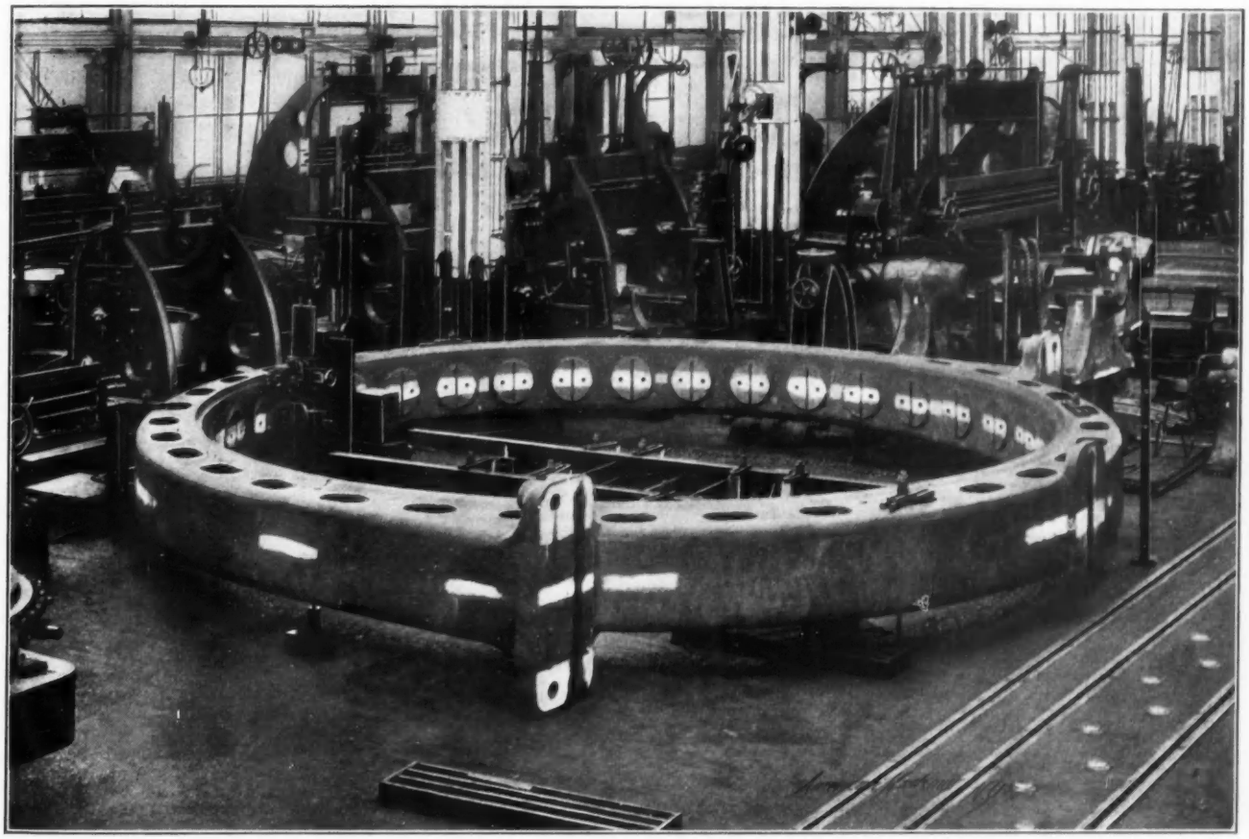
In turning, the speed must be slow. If fast, the edges of Mushet steel tools will be torn to pieces in short order, and again the metal must be cleaned, as it will be found that the steel is imbedded in the platinum.

Where a job can be soldered with fine gold it is easy sailing, but where only platinum can be used, on account of acid and fire tests, then welding must be resorted to. This is done by oxyhydrogen blowpipe, and is a most tedious operation, as it seems almost impossible to retain the shape of the article under the welding flame. Then the cleaning of the work is an operation that must be carefully performed. By this cleaning I mean the cleaning away of lumps and spots of metal that have been run by the welding flame. If these spots are not carefully removed, a crack will soon show itself when the article again comes under the hammer for shaping up.

As to the added infusibility resulting from the alloying of platinum with iridium, I can testify to the same from my practical experience—such as making welding fixtures to hold the work (while undergoing welding) of an alloy with a high percentage of iridium—the fixture giving greater resistance to the flame than did the article being welded. If one cares to look it up in the library, he will find that years ago Messrs. Deville and Debray made an alloy of platinum, iridium and rhodium which they claimed had been found capable of resisting higher temperature than platinum unalloyed. Pure unalloyed platinum is easy working compared with the alloyed; increasing the percentage of iridium seems to increase the difficulties in working.

I would advise those experimenting in this line to visit the firm referred to and to get from them just exactly what they want, as it will be almost impossible to save anything by attempting to make up crucibles or igniters; the waste in truing up the edges alone will destroy any chance of saving any expense by making it yourself. Platinum is a metal with most peculiar characteristics, and, to use the expression of one who tried to explain these peculiarities, "When you think you've got it you find you haven't got it." Ordinary fire will not melt it; it is regarded as the heaviest form of matter known; it expands less by heat than any other metal; is not acted upon by any single acid known; dissolves slowly in aqua regia; corrodes, however, if heated with the alkalies; smoke will injure it.

JOHN G. NIEDERER.



EXTENDING THE RANGE OF A BORING MILL.

A Shop Vote on Hours of Labor.

Editor American Machinist:

At page 975 you refer to a case of employees voting to decide change of hours. At the machine shop of Hugo Bilgram, Philadelphia, a few weeks ago, a large number of the hands asked for a change of hours, so as to close Saturday at noon and thereby reducing time to 57½ hours per week.

By Mr. Bilgram's direction the question was put to vote, a large majority deciding in favor of the reduction, which is now in force.

E. J. BOWERS.

Philadelphia.

Manufacturing Connecting Rods for Steam Engines.

Editor American Machinist:

The connecting rod is one of the most expensive parts of an engine and the part that is subject to more wear and which requires more repairs than any other. Therefore it should be of the best material and workmanship. The connecting rods and boxes for the engines under consideration were bought from outside parties, who claimed to manufacture nothing else, and who therefore could sell to engine builders at less cost than they themselves could make them. The rod and boxes complete for a 10x12 inch engine cost $13.50, delivered at the engine works in lots of twenty-five or more.

The body of these rods was rectangular, being about 2½ by 1⅛ inches at the cross head end and 3 by 1⅛ inches at the crank end. They were nicely milled all over and both ends had straps, gib and key. The boxes were brass, of rather an inferior quality. The workmanship was fairly good, perhaps fully as good as on rods used generally on agricultural engines. The quality as well as the cost not being satisfactory, it was determined to manufacture the rods at home, and, if possible, to reduce the cost and improve the quality.

Fig. 1 shows the design adopted. The body of the rod was smooth forged, and left unfinished. The boxes were of a good grade of brass. The take-up was accomplished by the wedge, as shown. In detail, the manufacture of the rod was as follows:

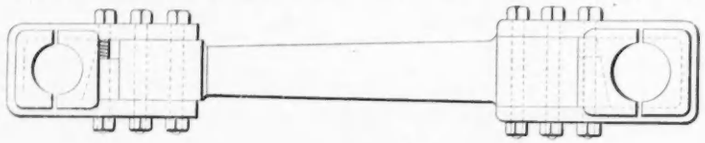


Fig. 1

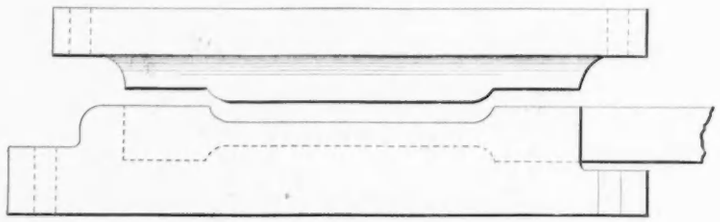


Fig. 2

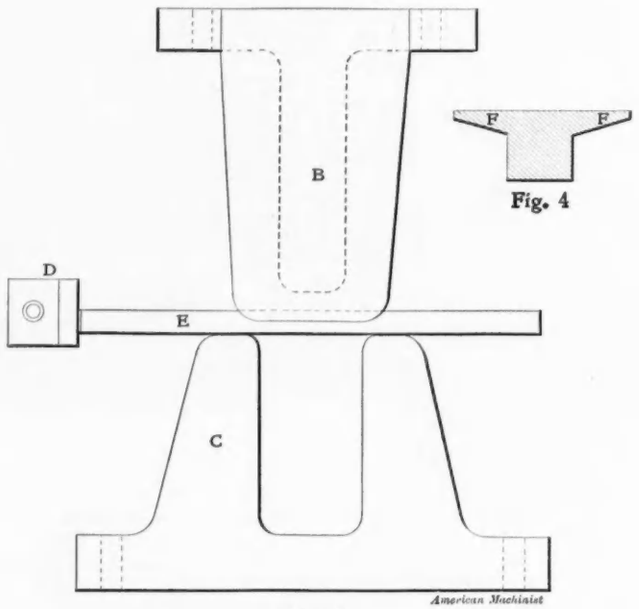


Fig. 3

FORGING CONNECTING ROD AND STRAPS.

Fig. 4

The body of the rod was forged from a bar of steel 3¾ by 2⅝ inches under a steam hammer, and in order to quickly bring the piece to a smooth finish and to uniform size, dies were made as shown by Fig. 2, the sunken die being keyed and bolted to the anvil block, and the male half to the head of a drop hammer. The bar of steel being of the proper size for the crank end of the piece without forging, that end of the die was made large enough to receive the bar when hot. The body of the rod and the cross-head end were forged slightly smaller than the die the wide way, and slightly larger the other way. After forging, the piece was brought to a bright red heat and placed in the die and the hammer dropped on it, forcing the surplus thickness of metal to fill the die, thus making a smooth piece of work and any surplus being forced out at the bar end. The work was done before cutting off from the original bar, thus avoiding all waste. This piece of forging weighed 32 pounds; the material at that time cost 1⅞ cents per pound, thus making 60 cents. A blacksmith and helper together receiving $4.50 per day forged 20 rods, about 22½ cents per rod. Adding to this 25 per cent. for fuel and repairs, we have a cost of $1.03 each for this piece.

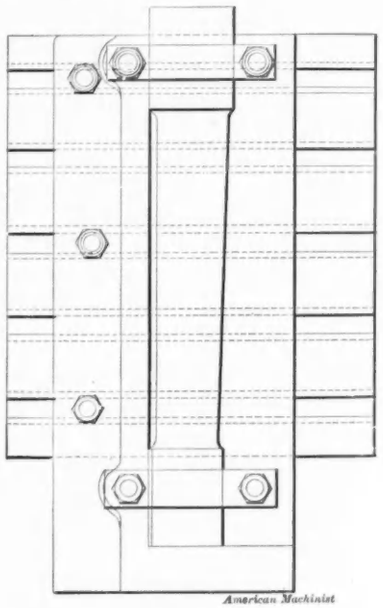


Fig. 5

FOR PLANING THE ENDS OF THE RODS.

The straps were made of 2⅝ by 1⅛ inch steel weighing 28 pounds and costing 52 cents. These were cut from the bar in proper lengths, heated in a heating furnace and bent to shape in a bulldozer. When evenly heated they were placed in the die, as shown in Fig. 3, one end resting against the stop *D*. Fig. 3 shows the die and plunger, Fig. 4, a section of the plunger, *F F*, being a guard extending over the plunger to prevent the piece which was being operated upon from getting out of place. One revolution of the machine forced the plunger forward and back again to the starting point, each revolution bending a strap into perfect shape. Two men using a shear and this machine could cut off, heat and bend 400 straps per day of

ten hours, costing a little over one cent each in labor. Adding to this an allowance for fuel and dies, and the cost of material, we have the two straps completed at a total cost of 61 cents. The method used in bending these straps was to cut off sufficient blanks of various sizes to keep the machine working a day or two at a time. In two days, including changing of dies, sufficient straps could be bent to keep the works supplied for several months.

No doubt there are many readers of the "American Machinist" who never saw or heard of a bulldozer. This machine is now extensively used by builders of agricultural machinery for forming all varieties of shapes. It would probably not pay engine builders to put in this machine unless requiring many forms of bent work, as such a machine would bend from eight to twelve thousand straps per month, if working on them alone.

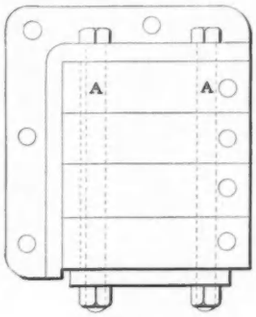


Fig. 6

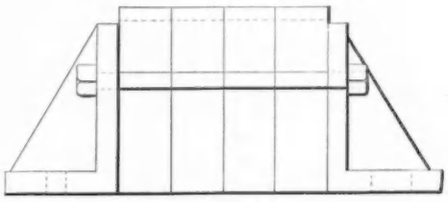


Fig. 7

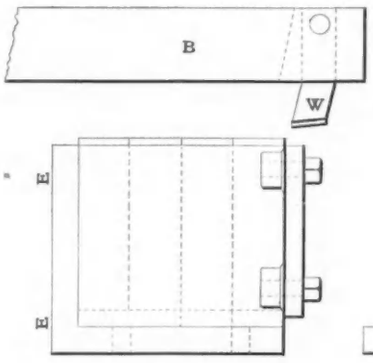


Fig. 8

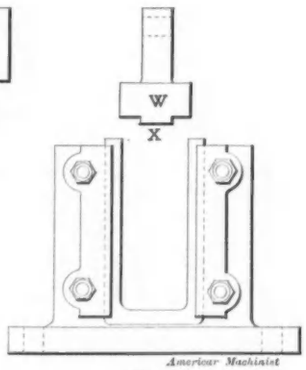


Fig. 9

MACHINING THE STRAPS.

We now have the forgings complete for a 10 by 12 inch connecting rod at a cost of $1.64. The ends of the rods were finished on all four sides in a milling machine, six at one time. These could be milled complete in two hours at a cost of 40 cents. Adding to this a percentage for keeping up the cutters, etc., we have a cost of 8½ cents per rod.

The next operation was finishing the ends of the rods. This was done in a heavy draw-cut shaper. A chuck (see Fig. 5) being bolted against the head of the shaper and holding six rods, they could be planed on both ends in 1½ hours, costing in all 30 cents, or 5 cents each. The complete machining of the rod, therfore, cost 13 cents.

The straps were milled on edges, sides and ends. In order to mill the edges, they were placed in a chuck, the open ends being kept from crushing by a small jackscrew in each strap. In order to mill the sides, they were placed as shown (see Fig. 6), the milled edge being held against the angle plate by bolts *A A*. To mill the ends, two angle plates were used, one of them having slotted holes, as shown in Fig. 7. After all the outside surfaces were milled, they were taken to the shaper where the inside surfaces were finished. The shaper used in this work was a heavy draw-cut machine—that is, one in which the cutting is done while the ram is moving inward. The cross-rail had an up-and-down feed. A chuck (Fig. 8) was placed on top of the sliding head with surface *E E* resting against the housing of the machine. Cutter bar *B* was attached to the ram, the roughing cutter *W* cutting at both ends, the lip *X* removing part of the stock at the end of the strap. The finishing cut was made with a double-end cutter of exactly the width required, which also cut away the remaining stock at the end. The milling and shaper work was done with a liberal supply of oil. Six sets of straps were milled on all the outside surfaces in six hours. The shaper work required three hours. The total cost in labor was $1.80, about 30 cents per set.

The adjusting wedges were made from a bar of cold-rolled steel of the proper size. This was placed in a jig and milled off on one side to the proper angle and cut to length with a slitting saw. These were made in large lots at a labor cost of 3 cents each.

The brass boxes for each end were cast in one piece. The weight of these per set was 8 pounds. Brass castings at that time cost 15 cents per pound, making the cost per set $1.20. They were bored and faced in a turret lathe, then placed in a jig in a double-spindle milling machine, and milled on all four sides to fit the straps. They were afterward cut in two with a slitting saw. These boxes were machined in lots of from 50 to 100, the labor cost being 20 cents per set.

Each connecting rod required four bolts for bolting the straps to the body of the rod, and two bolts for the adjusting wedges. These were made in a turret machine from hexagon stock, costing in labor 25 cents and in material 17 cents. Jigs were made for drilling the straps, the body of the rod and the adjusting wedges. Drilling these cost 30 cents.

The assembling of the various parts was done by the piece, for which 75 cents per rod was paid. This work included smoothing up the sharp corners, tapping the holes in the wedges, and fitting the boxes to the straps. The various items of cost were:

Forgings, including material for the adjusting wedges	$1.69
Machining rod body	.13
" straps	.30
" wedges	.03
Brass boxes	1.20
Machining boxes	.20
Material for bolts	.25
Making bolts	.17
Drilling	.30
Assembling	.75
	$5.02

Adding 25 per cent. for shop expense we have total cost $6.27.

In this and previous articles I have described the tools and methods used in the manufacture of the various parts of a 10 by 12 inch engine, by the means of which the plant was brought up from a non-paying condition to a very profitable one.

The smaller parts, of which there has been no mention made, were all machined in the usual way, the work on them being done by the piece. B. W. T.

Smoke Consumption and Smoke Prevention.

Editor American Machinist:

The strike of the miners of anthracite coal and the temporary scarcity of that unique fuel calls increased attention to what is by no means a new or unfamiliar problem of engineering, the burning of bituminous coal, especially in the large quantities involved in the development of light and power in the large towns and cities, without defiling the atmosphere with smoke. Although, as I say, this

problem is engaging more than usual attention at the present time, it is in no sense a temporary one, but must continually increase in urgency until a satisfactory solution is arrived at. It seems to be self-evident that the proportion of anthracite coal used must continually decrease. It is asserted that even now in many mines twelve tons of water must be brought to the surface for each ton of coal raised, and the coal when brought to the light has still to go through an expensive process of breaking and sorting before it is ready for the market, none of which expenses attach to the mining of bituminous coal. It is to be remembered also that while anthracite is found only in a single restricted locality of the United States, bituminous coal occurs in unlimited quantities in widely separated areas, so that it is procurable everywhere without excessive cost of haulage. It is becoming almost the universal fuel of the Union, and, as long as it lasts, of the world. It is therefore of urgent importance that we learn to burn it most economically and with a minimum of objectionable accompaniments. Of the smoke nuisance it is entirely unnecessary to speak. It speaks for itself, not only as a nuisance, but as a waste. Its story is one of failure in the carrying on of a simple process, and it is one that is not to be regarded without more or less of humiliation. We have not only generally to learn how to burn coal without smoke, but we have also to insist that it shall be so burned, at least in all localities where men most numerously dwell. The thought is intolerable, for instance, that New York City shall be surrendered to the smoke fiend, and if the sky of New York can be kept clear, what other city can consent to its permanent obscuring and defilement? Smoke is dirt, but it is no more dirt in New York than it is in Chicago, in Denver or in San Francisco.

It is not for me here to indicate how the smoke evil—nuisance is a word too mild and inadequate—is to be abolished. A very necessary thing not yet accomplished is to induce a belief that it can be abolished. There are many men who are telling us now that it cannot be. At least that is what they think they are telling us, when they assert that there is no successful smoke consumer. Certainly not. Wye Williams was telling us that about half a century ago, not to mention the numbers who have since told us the same, and we have not learned it yet, although it still seems to indicate our only way out. We are hearing altogether too much in these days about smoke consumers, when the presumption is always and necessarily all against them. The sooner we completely realize that no ingenious inventor can ever be expected to devise any claptrap contrivance that can be applied to any smoking boiler furnace and make it burn clear, with the escaping gases at the top of the chimney invisible, the sooner will we have learned one very essential lesson. Burn the coal without producing smoke and you are all right; burn the coal —if it may be called burning it—with dense clouds of black smoke pouring from the chimney top, and then attempt to undo the completed operation by burning the smoke, and you are attempting the practically impossible.

It is not unknown how coal may be burned without smoke. There are several conditions to be insisted upon. It is a question of the relative volumes of air and of fuel commingling at the right time in chambers or passsages of sufficient capacity, and especially of the maintenance of a sufficiently high temperature until the operation of combustion is completed. The generation of the heat by the combustion of the coal is one thing. It is an operation very insistent as to its conditions, but must be acquiescent and reliable when the conditions are satisfied. The transmission of the heat to the water which we wish to convert into steam is an entirely distinct affair. The almost universal vice of the boiler designer has been that he has kept only the boiling operation in view. He has been so anxious about not only getting sufficient heating surface, but of getting it as near as possible to his fire that he has partially extinguished his fire, which is really all that the smoke means. If the coal could be first completely burned and all the possible heat generated, that heat need not escape if later the means of heat transmission were provided. The most effective and therefore the most valuable heating surface of a boiler is reckoned to be that in the furnace immediately over the fire. It is this very surface—especially if very near the fire—which often acts to interfere with the combustion and to produce smoke instead of flame,, so that if the combustion were conducted in a separate chamber and if the boiler had no surface exposed to the direct radiation of the fire, the combustion might be perfect and smokeless, and then if the products of combustion were allowed sufficient and sufficiently prolonged contact with the boiler surfaces, external or tubular, there would be no question about the absorption of the heat by the water. With boilers so constructed or so set that perfect combustion is impossible, the failure of any "smoke consumer" or of every smoke consumer, when applied to them, contains no evidence bearing on the case of smokeless combustion. A smoke consumer in any case is working, or trying to work, at the wrong end.

Very few if any internally fired boilers can be expected to be made smokeless, and at the same time to produce the weight of steam that is expected of them. One must be a visionary indeed, for instance, to propose to make a torpedo-boat boiler smokeless; but with stationary boilers of the ordinary types it should not be impossible to so arrange the furnaces and flues and the system of firing that there would be no call for chimerical "smoke consumers." The changes required in existing boilers, or rather in their settings, might be expensive, but with new installations it should not be so, and our hope of smokeless fires should first be realized with the latter. Wherever smokeless firing is accomplished and maintained, we may at once insist that others shall do likewise. TECUMSEH SWIFT.

The Core Box Plane.

Editor American Machinist:

In endeavoring to construct a plane for small core boxes as shown in your issue No. 43, I was undecided from your drawing how to place the wing. The drawing shows the plane on top of the wing at the end view and the plane at the edge of the wing at the bit. This latter I take to be correct. The device illustrat s a geometrical theorem very prettily.

JAS. F. BARKER.

Department of Manual Training, Milwaukee High Schools.

[The wing can probably be fastened more securely and located more accurately by the dowel pins if fastened to the bottom of the plane. The cutter or "plane iron" must of course then be set down far enough to reach the corner. If this cannot be done, the wing must be fastened to the side of the plane. Instead of the wing of wood fastened to the bottom of the plane a thin plate of steel might be used.—Ed.]

Call From a Swindler—The Metric System.

Editor American Machinist:

We were favored by a visit from the young rascal who recently victimized one of your subscribers by representing himself as the son of a large Newcastle shipbuilder. He got nothing from us, thanks to your publication. He calls himself H. G. Tweedy, and gave his residence, 323 West Eighty-fourth street, New York.

I notice that you favor the introduction of the metric system. You have doubtless given this matter full consideration. We have in this country a perfectly satisfactory system of sizes for drills, reamers, arbors, taps and piping. When we adopt the metric system, which one of the very numerous metric systems do you recommend? Of course you know that in these matters no standards have been universally adopted in the metric countries; that, for example, the French army use one standard, the navy another.

We are sure that you are far from desiring to recommend impossibilities. Do you think it *possible* that the American mechanics could be induced to exchange their present perfectly satisfactory standard for any one of the European metric standards as long as the present confusion exists in these matters in those countries?

Referring to the letter of your Barcelona correspondent in your issue No. 39, you

will notice that he says that the Whitworth threads are also standards in Spain. Before we change anything, had we not better wait until the metric countries agree among themselves. HENRY BINSSE.

Newark, N. J.

[Mr. Binsse is mistaken when he says we "favor the introduction of the metric system." We do not advocate its adoption here, especially not by statutory compulsion. It is our conviction, however, that most of the arguments that are brought against the system are fallacious, and we intend so far as possible to help our readers to be unprejudiced and to know what are and what are not valid objections to an attempt to force its use here. Especially do we believe in the value of the testimony of those who for any reason have tried the metric system after having first been accustomed to the English system. Our conviction is that the metric system will make more or less headway here, as it is in fact now doing, because of the growing tendency to international trade and because each step toward its use will appear to the one who takes that step to be a profitable move or the "line of least resistance." It is probably gaining ground relatively faster in Great Britain than here, chiefly from commercial considerations, and whatever may be our personal predilections for the one system or the other, we must not blink the facts. That several different metric systems are used is news to us. We had thought there was only one, and are not yet prepared to believe there are more, though there are some variations by partial adoption of *the* metric system.—Ed.]

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(24) A. C. M., Los Angeles, Cal., asks: Can the space between two bevel gear teeth be cut theoretically correct with a single milling cutter with a single cut? A.—We do not know, but we believe it never has been done.

(25) F. L. L., Manchester, N. H., refers to the table for spacing holes in circles published in our issue No. 31 and asks: (1) Why is it necessary to draw two diameters to the circle to be spaced as called for in the article? A.—It is not necessary. Probably the author was under the influence of habit when he wrote the article. (2) Has a similar table been published but working in the reverse way—that is, giving the diameter when the number of spaces and the length of each is known? A.—We know of no such table. (3) At what temperature does hard babbitt metal melt? A.—The composition of the alloys which go under the name of babbitt metal varies so widely that it is impossible to name a definite figure. Speaking generally, the melting point varies between about 660 and 900 degrees Fahr.—the latter figure going with the higher grades of metal containing copper.

(26) C. C., Newark, N. J., asks: What is the correct spelling of the word pein or pene, and what does it mean? A.—The Century Dictionary spells it peen, but gives also four alternative spellings, pean, pene, pein and piend, either of which may be assumed to be permissible. It is better, of course, that we all spell it peen. The word means the opposite end of a hammer from the face. The word may originally have been pin, which was sometimes used for a peak or pinnacle, which the peen of a hammer often is. "Up to this pynnacle now go we"; "I xal the sett on the hyghest pynne" (I shall thee set on the highest pin). It is a curious thing that the word pane was some time used for the face of a hammer, and the two ends may have been confusingly called pane and pene, just as the two sides of the ship were called larboard and starboard.

(27) "Subscriber" asks for information regarding the premium rates actually paid in shops where the premium plan is in use. A.—This subject has been discussed quite fully in our columns, but as a summary we may say that the premium rates range between one-quarter and one-half of the wages rates, the average being not far from one-third. This latter figure seems to offer sufficient incentive, unless the work is quite laborious or unless production is already at nearly the maximum, and we have known excellent results to be obtained with the lowest rate named. One of the earliest users of the plan who recently took charge of another shop, and thus had an excellent opportunity to make full use of several years' experience, adopted a fixed premium rate of 8 cents an hour for all ordinary work. Previously he had had a schedule in use, in which the premiums were made a constant percentage of the wages. The result of this method is, of course, to lead to fractional figures in the premium rates, which add to the labor of calculating the premiums. The use of a fixed whole-cent rate obviates this; and, moreover, 8 being divisible by 4, leads to even cents for each quarter of an hour, while the figure named was a fair average of the miscellaneous rates previously used. This plan has much to commend it for most of the work done, though in the case of apprentice boys or of exceptionally high-priced men using large, expensive tools, or of very laborious work, it would probably be wise to use other rates adapted to the circumstances.

(28) A. B. B., Cleveland, Ohio, asks: (1) Do you know of a cement or glue that will fasten cloth or paper to iron? A.—In fastening emery cloth or paper to the disks of the Gardiner grinder, common glue is used, though the spiral grooves in the disk are doubtless an important aid in giving the glue a grip. Other makers of disk grinders, who do not use the grooves, have special cements of the composition of which we are not informed. (2) What are the proper speeds at which to run soft steel and brass in automatic screw machines, a flood of oil being used on the work? A.—This question was referred to the Brown & Sharpe Manufacturing Company, who answer it as follows: "Brass can usually be run as high as 150 feet a minute, and soft steel from 40 to 60 feet for forming tools with fine feed, .00025 to .0005 deep per revolution, and from 30 to 40 feet with hollow mills or box tools, the feed of the latter not being over .01 per revolution, and the chip 1-16 inch deep. If the chip is deeper, the feed should be finer or the speed slower. For threading, the speed should not be over 20 to 30 feet, depending on the pitch of the thread. These figures are for sizes from ¼ to ¾ inch. For larger sizes the speed would be better slower and the feed coarser. These speeds are often exceeded in some cases with light cuts, and no rules can be laid down which will suit all cases." (3) Does the success of the Gardiner grinder depend on the spiral groove in the face of the disk or on the high speed employed? A.—Mr. Gardiner informs us that he considers the chief factor lies in the use of emery cloth or paper. A comparison of a sheet of such cloth or paper with an emery wheel is enough, he thinks, to show why the former cuts better. At the same time, he considers the spiral groove a factor. The disks of these machines do not run at higher speeds than emery wheels—5,000 feet per minute at the periphery being suitable for steel or iron. Your question regarding the speed of polishing wheels was answered in a special article in our issue No. 41.

Technical Publications.

"Engineering Studies—Part II: Roman Stone Arches." By Charles Evan Fowler. Fifteen 7x10½-inch pages, with eight illustrations. The Engineering News Publishing Company, New York.

This is a well-printed pamphlet with excellent half-tone illustrations of several of the stone bridges and aqueducts built by the Romans, most of which are still in use and in excellent states of preservation. We have not before seen pictures of so many of these great engineering works brought together. The descriptive notes are brief and relate to the architectural rather than the engineering features of the works.

"The Mechanical World Pocket Diary and Year Book for 1901." 238 4x6-inch pages. "The Mechanical World," Manchester, England. Price sixpence.

This is one of several pocket books published by English technical journals of which a new edition is published annually, the book under notice being now in its fourteenth year. New matter is of course added from year to year, though it is impossible to say how much is new in any

case without a critical comparison with former issues. Electricity naturally comes in for a steadily increasing share of space. The striking feature of all these publications is their low price. In that respect we have nothing in this country to compare with them.

"Progress of Invention in the Nineteenth Century." By E. W. Byrn. 476 6½x 9½ inch pages, with 306 illustrations. Munn & Co., New York. Price, $3.00.

This elaborately illustrated and well-printed volume will be found of interest by all who are interested in the effects of invention on modern life. The field covered is of course of enormous extent, and while the book does not claim the exactness of a technical treatise, it gives rational descriptions of the principles of the inventions included. Many, we fancy, who have been unable to keep up with the bewildering progress of science in recent years as published by the periodical press, will find here just the concise résumé of many recent discoveries that they need.

"Theory and Calculation of Alternating Current Phenomena." By Chas. P. Steinmitz. 525 6x9-inch pages, wtih 210 illustrations. Third edition. The Electrical World and Engineer. Price, $4.

The author of this volume is well known as a master of the complex phenomena of the alternating current, and the work is the most complete and profound exposition of those phenomena extant. It is of course highly mathematical and is intended only for those who are capable of reading highly scientific and mathematical abstractions. That such a book should reach its third edition in as many years is distinctly creditable to the capacity of electrical engineers, as its original publication was creditable to its publishers and the country of its production. In the third edition several new chapters have been added and others have been largely rewritten and enlarged.

"Slide Valve Gears." By F. A. Halsey. 203 5x7½-inch pages, with 109 illustrations. Sixth revised and enlarged edition. D. Van Nostrand Company, New York. Price, $1.50.

The chief addition in the present edition of this book is the section on the locomotive link motion, which comprises 64 pages and 30 illustrations, and which was first published as a serial in our columns in 1897. Our readers will remember that the link-motion practice presented is that of the present day, and is based on facilities for the study of their work which were extended by the Schenectady Locomotive Works. The chief change in the older portions of the book consists of an enlargement of the chapter on exhaust lap. The leading feature of the entire book is the fact that the movement of the valve is treated in the manner in which it is laid out by the designer—by purely graphical constructions and without algebra. It is hence within the capacity of anyone to read.

"Free-Hand Perspective." By Victor T. Wilson. 257 6x9-inch pages, with 139 illustrations. Wiley & Sons, New York. Price, $2.50.

Perhaps the best idea of the scope of this book is given in the following quotation from it: "With the measurement of the sizes of parts he [the artist] cares very little about the geometrical exactness of his estimate; the true impression upon any observer is what is striven for. This is the spirit in which the subject will hereafter be treated in this book, so far as it is possible to apply it to the study of principles which are more or less rigid, and in all cases founded upon geometrical facts." It aims first to explain the principles of geometrical perspective, and then to show such modifications and compromises as are permissible for greater simplicity or necessary in many cases to produce results which are more satisfactory to the eye. "The constantly shifting actual observer requires the draftsman to use license in the application of perspective rules, and he is conceded this license by custom without comment." It is recognized that the artist's perspective is largely a matter of intuition, but with the qualification that "to draw intuitively, one must draw, if at all, through the medium of a well-defined basis of principles." "With constant practice the application of perspective principles becomes unconscious," and the author aims to so teach these principles that they may be thus applied. Many of the examples are of engineering details, and we believe that perspective sketching, taught as it is here done, will be of vastly greater usefulness to engineering students than when taught, as usual, through the medium of geometrical models. The usual method teaches the student to draw what is before his eye, but the trouble is that usually when the engineer desires to sketch anything it is not before his eye. If it were there he would have no need of sketching it, and drawing from models gives no practice in and almost no help toward drawing the thing which is seen in the mind's eye only. The engineer can have no more useful attainment than that of a ready command of the pencil in free-hand perspective sketching, and, if taught by the methods here laid down, the student should obtain such command to a far greater degree than has been usual in the past.

A series of evening lessons in machine-shop practice and tool making, also one in mechanical drawing, are to be given this season at the Mechanic Arts High School Building, Springfield, Mass. The classes will be in charge of Frank E. Mathewson, instructor in machine-shop practice and drawing at the Mechanic Arts High School, assisted by Edward Markham, superintendent of the Waltham Watch Tool Company, of Springfield. These classes are free to residents of Springfield, non-residents being charged a fee. The equipment of the school machine shop comprises ten engine lathes and a number of other tools.

Instruction of a high grade is offered at the evening classes of the West Side Young Men's Christian Association, of New York City, 318 West Fifty-seventh street. Courses which include both elementary and advanced work are given in science, arts, modern languages, technical instruction, mathematics, music and commercial branches. Especially strong work is being done in drawing and the other technical subjects. Courses are offered in simple and advanced mechanical drawing and architectural work, also free-hand and water-color instruction.

A number of courses of free lectures are being given in different parts of New York City under the auspices of the Department of Education. One of them is a series of eleven lectures upon electricity and physics being delivered at the Baronde Hirsch Trade School, 222 East Sixty-fourth street by W. W. Ker and F. W. Huntington. At Cooper Union, seven lectures on physics are being given by Prof. E. R. von Nardroff; at Public School No. 86, Ninety-sixth street and Lexington avenue, ten lectures on physics by J. Newton Gray and Mr. Huntington, and at St. Bartholomew's Lyceum Hall, 205 East Forty-second street, eleven lectures on physics and electricity by Prof. von Nardroff and Mr. Ker.

Good evidence of the progress which is being made in the development of the automobile as a practical road vehicle is afforded in the recent trip of a machine from Springfield, Mass., to New York city, a distance of 152 miles, in 16 hours and 10 minutes. The machine was operated by two amateurs, and no accident or noticeable incident occurred. It was a steam machine using gasoline for fuel. The total weight, including the two passengers, was about 800 pounds. The time given included all stops, for replenishing fuel and water supply, etc.

Referring to our illustration at page 983 of an improved driller, which we stated was, to the best of our knowledge, a new one, W. F. & John Barnes Company, of Rockford, Ill., write us that this is essentially the same as a machine which they made for their own use sixteen years ago and that has been in use in their factory since. They send us a photograph to sustain their statement. They had not placed the machine on the market or made it generally known heretofore, because they considered it special.

The Société des Chantier et Ateliers de Saint-Nazaire (Penhöet), France, which has the shops of the Compagnie Générale Transatlantique, since their reorganization for the purpose of taking in outside work, has received an order for the engines of the "Léon Gambetta," an armored cruiser of high speed, now being constructed at the arsenal of Brest. This cruiser will have three engines, with a total of 27,000 to 28,000 horse-power and will drive three screws to furnish a speed of 23 to 24 knots. The engines for the "Jules Ferry," another armored cruiser building at Brest, will be made at the works of Indret. The contract with the Saint-Nazaire company amounts to nearly $1,000,000. There are now 2,000 workmen engaged at this shop in order to finish "La Savoie," a sister ship of "La Lorraine."

The street railways of America now represent the enormous investment in bonds and stocks of $1,800,000,000, upon which investors are receiving annually over $70,000,000 in interest and dividends. Salaries and wages amounting to $250,000,000 a year are distributed among the 300,000 employees necessary to equip, operate and manage this great industry, repair its 20,000 miles of track, handle its 60,000 cars and meet the ever-pressing demands for improvement. Directly and indirectly over 1,200,000 persons depend upon the traction interests of America for their livelihood.—JOHN M. ROACH, President American Street Railway Association, at Kansas City Convention.

According to a press dispatch from Sioux City, Iowa, H. J. Conlon, of that town, one of the four members of the Board of Arbitration of the International Association of Machinists, announces that a demand has been made for 10 per cent. advance in wages. A strike of 60,000 men is threatened. The settlement of the strike last spring for a nine-hour day is said to have been construed by the National Metal Trades Asociation to include a reduction of pay. The men want ten hours' pay for nine hours' work.

A recently patented fire extinguishing compound is composed of a solution in 20 kilos (44 lbs.) of water, of 10 kilos (22 lbs.) of sulphate of alumina, 1,600 grains (56 oz.) of borate of sodium and 800 grains (28 oz.) of boric acid. Before using add a certain (uncertain rather, as the quantity is not given) amount of water.

Spain, according to report, is to rebuild its navy, and its friends, the French, are receiving the contracts. An order has been given, says a French paper, for eight ironclads of 12,000 tons burden each, four armored cruisers of 8,000 tons burden each and 100 torpedo boats. The work is to be executed within ten years.

Some comment is going the rounds regarding the performance of an electric company in suspending a motor-driven lathe in mid-air, connecting a wire to it and having it at work turning a piece of shafting while thus suspended from a crane. The idea of the electric company, of course, is to show the facility with which power can be applied, no matter what position a machine tool may be in. The sight of a lathe working in mid-air, however, ought to have another lesson for machine-tool designers, it seems to us; *i. e.*, that a machine tool should be capable of taking care of the stresses set up within itself and without reference to floor or other supports upon which it may stand. This is a point too often overlooked by machine-tool designers, especially where tools are to stand upon ordinary floors which are not particularly rigid and are liable to constantly varying flexure, depending upon the amount and distribution of the loads upon them.

The first meeting of the season of the Junior organization in New York City of the American Society of Mechanical Engineers was held at the house of the society, 12 West Thirty-first street, November 13. A paper was read by John C. Wait on "The Laws of Construction Contracts."

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Model, experimental and fine tool work. Pollard Alling Mfg. Co., 35-37 E. 20th st., New York City.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Compact, belt-driven air compressor, 50 cubic feet per minute to 100 lbs. C. P., care AMERICAN MACHINIST.

Machines constructed, detail drawings made for the trade. Address "Shop Experience," care AMERICAN MACHINIST.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams, and duplicate small machine parts, in quantities.

Parties having engines, boilers, pumps or machinery of any kind, or in need of any of the above, will find it to their interest to let us know. Box 56, AMERICAN MACHINIST.

Wanted—21 in. turret lathe, 60 in. vertical boring mill, 20 in. drill, No. 2 milling machine, 14 in. brass finishing lathe; must be cheap, good second-hand tools. Box 54, A. M.

For Sale, Cheap—Warner & Swasey screw machine, 1⅞ hole in spindle, used about six months; chuck takes full size; two cut-off attachments. Betty & Mabbett Co., Rochester, N. Y.

Wanted—30 in. or 32 in. lathe, 20 ft. between centers; 3 ft. arm radial drill; ½ in. to 2 in. bolt cutter; keyseating machine; 5 ton hand-power traveling crane, about 20 ft. span. Address Box 55, AMERICAN MACHINIST.

Wanted—Names engine builders modern equipment for 100 H.-P. engine and compressor construction, ready to do prompt, first-class work to detailed plans and specifications. P. Q., care AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W. Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Practical mechanical draftsman wishes position in New York city. Box 63, AM. MACH.

General wood pattern maker; young, American and experienced. Address Box 43, A. M.

Machine draftsman wants situation; practical experience; fair ability; moderate salary. Box 60, AMERICAN MACHINIST.

Wanted—Position by a capable machinist; small shop and general work preferred. Address Box 53, AMERICAN MACHINIST.

Up-to-date machine-shop foreman, mechanical expert and good manager of men, wants a position. Box 52, AMERICAN MACHINIST.

A young practical mechanical engineer, with extensive experience, wishes position with large manufacturing company. Box 26, A. M.

Young draftsman, experienced in general mechanical and electrical drafting and designing, wants position. Address "F.," A. M.

Expert in designing and testing pumping machinery and air compressor desires situation in New York. Box 4, AMER. MACHINIST.

Expert designer of automatic paper cutters, with new and special devices, wants position in New York city. "Paper Cutter," care AMERICAN MACHINIST.

Mechanical engineer with years of practical experience in steam plant, mill construction and crushing-plant machinery; a position of responsibility is solicited. S. C., AM. M.

First-class draftsman and toolmaker wants charge of a small shop on automatic machinery; specialty, watch and optical tools. Address "Up-to-Date," care AMER. MACHINIST.

Graduate mechanical engineer desires position as assistant engineer or draftsman with consulting engineer or small manufacturing company; 3 years' experience; reliable. Box 61, AMERICAN MACHINIST.

Wanted—Position as foundry foreman; familiar with general machinery and engine work, in loam, green or dry sand, iron or brass; can furnish good reference. Address "Foreman," care AMERICAN MACHINIST.

Have held successively the positions of chief draftsman and designer, superintendent and general manager; owing to consolidation am open to engagement; references from former employer. Address Box 58, AM. MACH.

Position as pattern-shop foreman; well up in modern methods appertaining to economical shop management; have had 14 years' experience on engines, pumps and transmission machinery; good reference. Box 59, A. M.

If you need a first-class man having 18 years' experience in modern shop management on all types of engines and valve gears, machine tools, also general heavy and experimental machinery, look my references up; I can increase the quantity and quality of your work. Box 57, AMERICAN MACHINIST.

Help Wanted.

Wanted—An experienced cost-keeper; state experience and salary expected. Box 45, A. M.

Wanted—First-class draftsman on engine work. The Ball & Wood Co., Elizabethport, N. J.

Wanted—Experienced machine tool draftsman; state experience, age and salary expected. Address H. W. B., care AM. MACH.

Wanted—For a few months, a mechanical draftsman with practical ideas. Address, stating experience, Greenfield Machine Co., Greenfield, Mass.

Wanted—A first-class drop-hammer die sinker; steady work; good wages. United Shoe Machinery Co., McKay Dept.; Factory, Winchester, Mass.

(*Continued on page 46.*)

Inquiries for Machinery.

(135) Names and addresses of manufacturers of machines for making glaziers' zinc points.

(136) Machines for wrapping twine balls.

Personal.

Waldo H. Marshall, superintendent of motive power and machinery of the Lake Shore & Michigan Southern Railway, gave the second in a series of lectures in the railway course at Purdue University, Lafayette, Ind., November 1, his subject being "Locomotive Design."

Charles Davies has resigned as machine tool salesman for Bradbury & Co., Ltd., Oldham, England, in order to join the firm of Schischkar & Co., Stafford street, Birmingham. The latter firm has secured some valuable machine tool agencies, including that for the "Acme" multiple-spindle automatic screw machine. Mr. Davies has had a successful practical and commercial experience of twenty years.

Obituary.

James Bulger died in Brooklyn, November 8, seventy-eight years old. Mr. Bulger was a native of Ireland and came to this country with his parents about 1830. He learned the machinist trade and conducted a shop in Brooklyn. For twelve years he had been totally blind and out of business.

A correspondent wants to know what there is in the way of a satisfactory substitute for benzine for cleaning bearings, shafting and machinery at work where insurance policies or leases prohibit the use of benzine.

New Catalogs.

Walter Scott & Co., Plainfield, N. J., have sent us a catalog of stereotyping and electrotyping machinery. Size, standard, 9x6 inches.

F. E. Wells & Son, Greenfield, Mass., send a catalog and price list of the "Economy" stocks and dies for threading pipe. Size, 5¾ x 7⅝ inches.

The E. R. Thomas Motor Company, Broadway and Elm street, Buffalo, N. Y., sends us a pamphlet descriptive of its gasoline motors and motor cycles.

The Chattanooga Machinery Company, Chattanooga, Tenn., has published a pamphlet illustrating and explaining the Catlin key-seating machine, which is one of its specialties. Size, 6¼x8½ inches.

The Worthington Pumping Engine Company has gotten up a Paris Exposition souvenir pamphlet, with views of Worthington pumps at the fair and explanations printed in French. Size, 7½x5 inches.

The Knell Air-Brake Company, Battle Creek, Mich., sends us its catalog of air brakes especially designed for use on electric cars, and operated by means of an axle-driven compressor. Size of page, standard, 6x9 inches.

O. S. Walker & Co., Worcester, Mass., publish a small catalog, "C," of their "Globe" tool-sharpener, described in our issue No. 44. It shows also planer parallels, measuring

(*Continued on page* 47.)

Help Wanted—Continued.

Wanted—Three first-class mechanical draftsmen with considerable experience in designing detail electrical apparatus. Address Box 50, AMERICAN MACHINIST.

Wanted—A competent and practical designer on sheet metal tools and special machinery. Address, with all particulars, "Sheet Metal," care AMERICAN MACHINIST.

Wanted—Foreman for foundry department of new brass shop, manufacturing steam fitters' goods; must be experienced and capable of taking entire charge. Address Box 38, A. M.

Wanted—Machinist, thorough die and punch maker, capable of taking care of special automatic machinery; state experience, age and salary desired. Address "Iowa," care AM. M.

Wanted—At once, two competent men for general machine work, also two experienced men on embossing dies. Apply immediately, Greenwood Bros. & Co., Gardner, Mass., Sta. A.

Wanted—Foreman for finishing department of new brass shop; must be experienced in the manufacture of steam fitters' goods and capable of taking entire charge. Address Box 37, AMERICAN MACHINIST.

Wanted—A competent, business-like foreman, familiar with press and die work; must be good machinist. Address A. L. W., care AMERICAN MACHINIST, stating fully age, experience and compensation expected.

Wanted—Machine tool salesman; must be capable and energetic; a practical man or technical graduate preferred; a first-class position for the right man; give full particulars. Box 51, AMERICAN MACHINIST.

Wanted—Three good draftsmen, familiar with laying out pipe plans for ice and refrigerating plants; state experience, age and salary expected and also give references. Address Box 62, care AMERICAN MACHINIST.

Wanted—An expert shop cost accountant, to organize new system in foundry and machine shop; must come well recommended and have good record; state age and experience in application. Address "Gears," care AM. M.

Machinists—Three or four first-class men, competent and familiar with erecting work, particularly steam engines and pumping machinery. Address, with full particulars, giving reference and salary desired. P. O. Box C, Saltville, Va.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

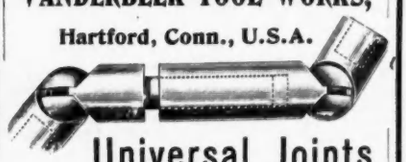
Wanted—Foreman for foundry employing 40 to 60 molders, making engine and boiler castings; married man preferred; state age, last employer and wages expected; A1 position for right man. Address "Jones," care AMERICAN MACHINIST.

A shop making 300 small automatic cut-off engines a year is looking for a superintendent capable of taking full charge of the manufacturing, with a view of increasing their output and sizes; a good opportunity for an up-to-date man. Address Box 366, AMER. MACH.

Wanted—A machinist with experience on die work, competent to build complicated machines and good on repair work; to such a man a good and steady position is open; give references, experience and salary expected. Address "M.," care AMERICAN MACHINIST.

VANDERBEEK TOOL WORKS,

Hartford, Conn., U.S.A.



Universal Joints

run at 70° angle; solid stems, which can be turned or bored out close up to the ball circle; bearing contact on whole circumference; little friction; simple; strong.

PRICES: ¾ in. **$1.50** each; 1 in. **$2.00**; 1¼ in. **$2.50**; 1½ in. **$2.75**; 1¾ in. **$3.00**; 2 in. **$3.25**; 2½ in. **$6.75** f.o.b. Hartford.

Beware of Imitations.

Wanted—25 good vise hands on light machine work; only good, steady men need apply; to such, good pay and permanent positions are offered; state age, wages now received, where you have been employed, whether single or married. American Machine & Foundry Co., Hanover, Pa.

Wanted—Draftsman; must have experience in air compressor and compound engine work; must be young and capable; permanent position and opportunity for advancement to young man of proper ability and character; good climate; give age, experience and references. Address, in own hand, Box 40, AM. M.

Wanted—Erecting superintendent for shop in New England, for vertical and horizontal engines, compressors and pumps; one who is a first-class mechanic and a hustler, and with good experience and executive ability; who has had experience in the erection of Corliss engines and marine work; good pay to the right man. A 74, AMERICAN MACHINIST.

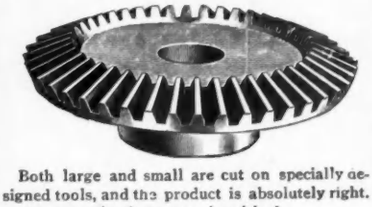
Wanted—Coppersmith for a permanent position, Central New York State; none but first-class, experienced men need apply; to receive consideration, applications must give full particulars as to experience and state how soon could come and wages expected; all applications that give information asked will be answered. Box 49, AMERICAN MACHINIST.

An English firm having a large repairing shop in Germany for portable engines and all classes of agricultural machinery, is desirous of engaging a capable man as superintendent and general foreman to manage the same; only a first-class man with foundry and machine shop experience need apply; state age, whether single or married, where been employed and salary required. Address Box 48, AMERICAN MACHINIST.

Wanted—Machine-shop foreman to take entire charge of machine shop employing 150 men on duplicate engine work; modern shop and completely equipped; will be supplied with assistant foreman and suitable clerical help; liberal salary; none but capable men of good habits need apply; state age, experience, references and salary expected; strictly confidential. Address "Ohio," care AM. M.

CUT GEARS

We cut bevel gears up to 8 feet in diameter with 24 inch face. We are specialists in the cutting of large gears. We cut small ones too.



Both large and small are cut on specially designed tools, and the product is absolutely right. S'pose you institute some inquiries?

R. D. NUTTALL CO.
PITTSBURG, PA.

HYDRAULIC JACKS

That are just exactly right in every way, and don't bear too heavily on the pocketbook of the purchaser.

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